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VOL. 86, NO. 2 JUNE, 1957

# THE PHILIPPINE JOURNAL OF SCIENCE

N.S.P.
J.R.A.M.
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MANILA
BUREAU OF PRINTING
1958

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COMMONWEALTH MYCOLOGICAL INST.
10 OCT 1958

# THE PHILIPPINE JOURNAL OF SCIENCE

Published by the Institute of Science and Technology
(Formerly Bureau of Science)

[Entered as second-class matter at the Post Office at Manila, Philippines]



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THE PHILIPPINE
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VOL. 86 JUNE, 1957 NO. 2

# COMPOSITION OF THE PULP AND SEED OIL OF KAMACHILE (PITHECOLOBIUM DULCE)

By LUZ G. GAMO and AURELIO O. CRUZ
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Kamachile, scientifically known as *Pithecolobium dulce,* belongs to the Leguminosæ. This species is a native of tropical America but is now thoroughly naturalized and widely distributed in the Philippines.

Brown(2) describes this species as follows:

*Pithecolobium dulce* is a tree 5 to 18 meters in height. The branches are armed with short sharp and stipular spines found at the bases of the leaves. The leaves are twice compound with four leaflets, which are 1 to 4 centimeters in length. The flowers are white and in dense heads which are about a centimeter in diameter.

According to Villanueva:(9)

The pods are rather smooth, turgid, twisted and oftentimes spiral. The pods are dehiscent along the border side. The spiral pods are usually from 10.9 cm. to 24 cm. long and from 1.6 cm. to 2.5 cm. in diameter. The pods weigh from 10.1 to 20.4 gms.

Concerning the oil yielded by the fruit, Kesava-Menon(7) states:

The seeds are black, shiny partly immersed in an arillus and replete with edible pulp of a yellowish white color. The pulp on extraction with ether yielded 18.22 per cent of a yellowish white oil with a beany smell which solidified at a temperature of 15° C. The expressed oil is yellowish white and very viscous and "stearine" deposits on standing. The kernels form 72.4 per cent of the seed.

The composition of kamachile beans from India was earlier reported by Church, as cited by Brown.(2) Padilla and Soliven(8) also made studies on the fresh seeds.

The kamachile fruits used in this experiment were purchased from one of the local markets.

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Fresh kamachile pods consist of 50.3 per cent pulp, 25.3 per cent seeds, and 24.4 per cent peelings. The seeds contain 18.3 per cent oil calculated on a moisture-free basis.

The seeds and pulp of fresh kamachile pods were analyzed for their moisture, oil, protein, and crude fiber contents according to official methods.(5) Results of analyses are given in Table 1.

TABLE 1.—*Composition of kamachile pulp and seed.*

| | Kamachile pulp | | Kamachile seed | |
|---|---|---|---|---|
| | Fresh | Dried | Fresh | Dried |
| | *Per cent* | *Per cent* | *Per cent* | *Per cent* |
| Moisture | 75.8 | ---------- | 56.4 | ---------- |
| Protein | 2.3 | 9.5 | 10.5 | 24.1 |
| Fat (ether extract) | 0.5 | 2.1 | 8.0 | 18.3 |
| Crude fiber | 1.1 | 4.5 | 3.9 | 8.9 |
| Ash | 0.7 | 2.9 | 1.6 | 3.7 |
| Carbohydrates (by difference) | 19.6 | 81.0 | 19.6 | 45.0 |

The resultant meal obtained after the oil was extracted from the seeds was likewise analyzed. The composition of the meal is given in Table 2.

TABLE 2.—*Composition of kamachile seed meal.*

| | Kamachile seed meal | |
|---|---|---|
| | Fresh | Dried |
| | *Per cent* | *Per cent* |
| Moisture | 7.2 | ---------- |
| Protein | 27.6 | 29.7 |
| Fat (other extract) | 2.2 | 2.4 |
| Crude fiber | 8.5 | 9.2 |
| Ash | 3.6 | 3.9 |
| Carbohydrates (by difference) | 49.1 | 54.8 |

Oil was extracted from the ground dried kamachile seeds with several portions of ether. The oil obtained was then treated with 2 per cent Fuller's earth and filtered to remove all solid impurities. The resultant clear yellowish oil was analyzed. The seed oil showed the following physical and chemical constants:

| | |
|---|---|
| Specific gravity at 30° C/4° C | 0.9044 |
| Refractive index at 29°C | 1.4546 |
| Color (Lovibond): | |
| Red | 5.7 |
| Yellow | 33.0 |
| Saponification value | 185.3 |
| Iodine value | 80.7 |
| Acid value | 1.2 |
| Unsaponifiable matter, per cent | 0.6 |
| Thiocyanogen value | 56.0 |
| Saturated acids, per cent | 24.3 |

The saturated acids were determined by the lead-salt ether method(6) while the other constants were determined in accordance with the Official and Tentative Methods of the American Oil Chemists Society.(1) The saturated and unsaturated glycerides of the oil shown in Table 3 were calculated from the iodine and thiocyanogen values of the oil. For purposes of comparison the composition of peanut oil and kapok seed oil are also included in Table 3.

TABLE 3.—*Comparison of Philippine kamachile seed oil with other oils.*

| | Kamachile seed oil | Kapok seed oil (3) | Peanut oil (4) |
|---|---|---|---|
| | *Per cent* | *Per cent* | *Per cent* |
| Glycerides of: | | | |
| Unsaturated acids— | | | |
| Oleic | 51.1 | 49.8 | 53.9 |
| Linolic | 24.0 | 27.6 | 27.0 |
| Saturated acids | 24.3 | 19.5 | 17.9 |
| Unsaponifiable matter | 0.4 | 0.8 | 0.3 |

As may be seen from Table 3, kamachile seed oil and peanut oil have about the same percentages of oleic and linolic glycerides. Kamachile seed oil has, however, a slightly higher percentage of saturated glycerides than peanut oil. In physical and chemical characteristics, kamachile seed oil also resembles kapok seed oil.

## SUMMARY

The composition of the fruit of Philippine kamachile was investigated and the analyses showed that the pulp has a high carbohydrate content.

On account of its high protein content, the residual seed meal obtained may be used for animal feed.

The composition of the oil extracted from the seeds was determined and the results indicate that kamachile seed oil is similar to that of peanut oil. Both oils have the same percentages of oleic and linolic glycerides. Kamachile seed oil has, however, a slightly higher percentage of saturated glycerides than peanut oil. Its physical and chemical characteristics are also similar to Philippine kapok seed oil.

Kamachile seed oil is suitable for edible use, for the manufacture of soap, and for other purposes for which peanut and kapok oils may be employed.

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# INTERRELATIONS OF PHYSICAL PROPERTIES, VII

## VALENCE, ENTROPY, ELECTRON CHARGE, SPECIFIC HEAT AND ATOMIC RADIUS

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In previous papers,(1, 2, 3, 4, 5, 6) it was shown that some physical properties of solids are interrelated and tied up with either the valence,(1, 2, 3, 4) or the nuclear charge.(5, 6) Now it will be shown that entropy, electronic charge, atomic radius, valence, specific heat and the linear cœfficient of thermal expansion are interrelated. Consider an electron of charge $e$ at a distance $r$ from the center of the positively charged nucleus, with a charge $Ze$, where $Z$ is the valence. The force of attraction $F$, will be equal to,

$$F = \frac{-Ze(e)}{r^2} \qquad (1)$$

The expression for work obtained from equation (1) by multiplying both sides of the equation by $dr$ which after dividing by a temperature change $dT$ becomes,

$$\frac{Fdr}{dT} = \frac{-dW}{dT} = \frac{-Ze^2dr}{r^2dT} \qquad (2)$$

Relating the work done to the heat $dQ$, we get,

$$\frac{dW}{dT} = \frac{dQ}{dT} \qquad (3)$$

If the heat capacity is $C$/gram-atom, then, for one atom,

$$\frac{C}{N} = \frac{dQ}{dT} = \frac{-Fdr}{dT} = \frac{Ze^2dr}{r^2dT} \qquad (4)$$

where $N$ is the Avogadro number. Equation (4) may be written also as,

$$\frac{Ze^2L}{r} = \frac{C}{N} \qquad (5)$$

where $L$ is the cœfficient of linear expansion. Hence,

$$C = \frac{NZe^2L}{r} \qquad (6)$$

If therefore the entropy $s$ is related to the specific heat and temperature by the equation, $ds = CdT/T$, the entropy may be related as,

$$ds = \frac{N Ze^2 L\, dT}{rT} \tag{7}$$

It might also be noted from (5) that the linear coefficient of thermal expansion may be given as,

$$L = \frac{Cr}{NZe^2} \tag{8}$$

An approximation may be resorted to at this juncture. If the heat capacity $C$ is equal to the specific heat $S_h$ multiplied by the atomic weight $W$, equation (8) becomes,

$$L = \frac{S_h W r}{NZe^2} \tag{9}$$

If the volume of the atom is the atomic weight divided by the product of Avogadro number and the density $D$, then $r$ in (8) may be taken from the volume of the atom,

$$4/3\pi r^3 = \frac{W}{ND} \tag{10}$$

Then if $4.17 \times 10^7$ is the mechanical equivalent of heat,

$$L = \frac{(4.17 \times 10^7)\, S_h W}{NZe^2} \left[\frac{3W}{4ND\pi}\right]^{1/3}$$

$$= \frac{S_h W^{4/3}}{ZD^{1/3}} / \frac{(4\pi)^{1/3}\, N^{4/3} e^2}{(3)^{1/3}\,(4.17 \times 10^7)} \tag{11}$$

If the electronic motion exerts pressure against the bounding surface of the atom, then,

$$\frac{mv^2}{r} = 4\pi r^2 P_1,$$

where $P_1$ is the pressure exerted by the electron on the atomic surface, and $mv^2/r$ is the centrifugal force. Solving for $P_1$

$$P_1 = \frac{mv^2}{r} / 4\pi r^2 \tag{12}$$

But since centrifugal force $m\ v^2/r$ equals the coulomb force, $Ze^2/r^2$ we have after solving for $v^2$ and substituting in (12),

$$P_i = \frac{m(Ze^2)}{r\,mr} / 4\pi r^2$$

$$= \frac{Ze^2}{4\pi r^4} \qquad (13)$$

The pressure $P_i$ will thus be inversely proportional to the fourth power of the atomic radius and directly proportional to the valence.

For the monovalent metals,

$$P_i\, r^4 = \frac{e^2}{4} = 1.88 \times 10^{-20} \qquad (14)$$

This is a universal constant. For the metals of the same valence, $P_i\ r^4$ is also equal to a constant.

It will be noted that since $r$ is of the order $10^{-8}$, the value of $P_i$ will have the same magnitude as the bulk moduli of metals, namely $10^{12}$ dyness.

TABLE 1.—*Showing the relation between valence, specific heat and linear coefficient of thermal expansion.*

| Metal | Z | $S_h$ | W | D | L | |
|---|---|---|---|---|---|---|
| | | | | | calc. (a) | Obs.(6) |
| Sb | 3 | .0504 | 121.76 | 6.691 | $1.2\times10^{-5}$ | $1.1\times10^{-5}$ |
| Bi | 3 | .0299 | 209.00 | 9.780 | $1.3\times10^{-5}$ | $1.3\times10^{-5}$ |
| C | 4 | .1400 | 12.10 | 3.51 | $1.4\times10^{-6}$ | $1.2\times10^{-6}$ |
| Co | 2 | .1017 | 58.94 | 8.90 | $1.2\times10^{-5}$ | $1.2\times10^{-5}$ |
| Fe | 2 | .107 | 55.85 | 7.88 | $1.3\times10^{-5}$ | $1.2\times10^{-5}$ |
| Au | 3 | .0313 | 197.20 | 19.32 | $1.0\times10^{-5}$ | $1.4\times10^{-5}$ |
| Hg | 1 | .0350 | 200.61 | 13.547 | $3.8\times10^{-5}$ | $4.1\times10^{-5}$ |
| Ru | 3 | .0611 | 101.70 | 12.20 | $9.8\times10^{-6}$ | $9.6\times10^{-6}$ |
| Ni | 2 | .1074 | 58.69 | 8.90 | $1.3\times10^{-5}$ | $1.3\times10^{-5}$ |
| Mo | 6 | .065 | 95.95 | 10.20 | $4.9\times10^{-6}$ | $4.9\times10^{-5}$ |

(a) $L = S_h W r/e^2 NZ = S_h W^{4/3}/ZD^{1/3}(e^2 4_\pi)^{1/3}\ N^{4/3} / (4.17\times10^7)3^{1/3}$

$= S_h W^{4/3}/\ 4.505\times10^5 ZD^{1/3}$; $e = 4.8\times10^{-10}$; $N = 6.02\times10^{23}$

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# NEW AND RARE FLAGELLATÆ FROM MANCHURIA, EASTERN ASIA

By B. W. Skvortzow
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SIX PLATES

Among the different groups of algæ, Manchurian Flagellatæ are hitherto very little known. Earliest papers on this topic were published by the author from 25 to 34 years ago, when he was a student of botany. They were very imperfect and contained only common European genera and species.

Some progress with this work have been made in 1925 when a new genus and species *Wislouchiella planctonica* (Volvocales) have been found in a lake plancton of the Sungari River valley near Harbinahd, the second interesting species, *Amphidinium Elenkini* Skv. (Dinoflagellatæ) was described from the stagnant waters.

The study of the genus *Trachelomonas* Ehrenberg (Euglenaceæ) in the same locality, during the years 1916 to 1924, resulted in the discovery of about a hundred of new species and varieties among which many are hitherto known only from this part of Eastern Asia.

This success stimulated the author to make further and thorough studies of the other Flagellatæ. The first part of this work was published in 1946, containing the descriptions of many new species of Dinoflagellatæ, Volvocales, Euglenaceæ, and lower Flagellatæ of the group Pantostomatinæ.

The present second part of the work was completed during the years 1946 to 1954. Collections to be studied were gathered in the suburbs of Harbin, in the marshy valley of the Sungari River. Samples from a *Drepanocladus exannulatus* moss swamp, with water of alkaline reaction, rich in nitrous matter, have been especially attentively studied. Microorganisms extracted from the moss, *Utricularia vulgaris, Potamogeton* and accumulations of *Spirogyra* and *Mougeotia,* during summer season, were examined immediately after excursion or after storing in ice-house for 2 to 4 hours. During winter, the samples of the moss were 1 to 2 weeks soaked with small amount of water under a temperature of 1 to 7°C in order to cultivate Flagellatæ.

In the course of several years, the *Drepanocladus* moss swamp were examined methodically at regular periods of time.

All species mentioned in this paper were described and sketched when alive. Some *Peridinia* were mounted in glycerine-gelatine for their drawings.

The scope of this paper is to present therefore the descriptions in Latin and the drawing of 323 species and varieties of which 279 are new to science, and 45 have been previously described, of which new names were given.

The author also proposes 18 new genera of which, *Printziella, Arnoldiamonas, Gordejeviella* belong to Volvocales; *Astasiella, Paramylomonas, Menoidiomonas, Baranovia, Ampullomonas, Schewiakowia, Mereschkowskiella, Baikowia,* and *Aliniella*—to Eugleninæ; *Nodeana, Loukashkinia, Spiromonas, Foliamonas, Serpentomonas,* and *Kuzminia*—to Pantostomatinæ, Protomastiginæ, Amphimonodaceæ, and Distomatinæ.

An account of all local species of *Chlamydomonas, Chlorogonium, Pteromonas, Polytoma, Astasia, Menoidium, Paranema, Petalomonas, Anisonema, Amphidinium* and others is, also given in this article. In many cases the typical European species have been substituted by closely related forms which, however, exhibited some peculiarities which are very important from the taxonomic view point. This paper was written under most unfavorable conditions due to the absence of contemporary literatures of the author dealing on this subject, and due to the lack of communication with scientific centers.

In conclusion, the author wishes to express his thanks to A. I. Baranov for correction made in Latin descriptions of new genera and species.

Herewith are given some abbreviations:

Longum, *lg.;* latum, *lt.;* micron, *mi.*

Habit prope Charbin in paludibus inter *Drepanocalus* exannulatus in aqua dulcis, Manchuria borealis, Leg. B. W. Skvortzow ..... Hab. 1

Habit prope Charbin in stagno, Manshuria borealis, Leg. B. W. Skvortzow ..... Hab. 2.

## VOLVOCALES

### POLYBLEPHARIDINÆ

### PYRAMIDOMONADEÆ

#### Genus PRINTZIELLA novum

Cellula fronte visa bursiculaeformis, asymmetrica, elongato-pyzamidalis; parte anteriore attenuata vel rostrata, parte posteriore alata, truncata, angulis rotundatis; latere visa elongato-ovata, curvata, obliqua; membrana tenuissima, hyalina; chloro-

plast parietalis pyrenoide 3; nucleus in medio cellulae; vacuola contractilis 2 et 2 flagellum, cellulae longiora, apice; stigma nullo; divisio cellulae longitudinales in motione. Dedico hanc generis Prof. H. Printz, Oslo, Norvege.

**1. PRINTZIELLA BIFLAGELLATA sp. nov.** **Plate 1, fig. 1.**

Cellula 22 mi. lg., 11 mi. lt. Hab. 1.

**2. PYRAMIDOMONAS VARIABILE sp. nov.** **Plate 1, fig. 2.**

Cellula sphaerica vel late rotundata vel cordiformis; parte anteriore rotundata vel abrupta; membrana hyalina indisticta; chloroplast parietalis, homogenea, viridis; pyrenoide centralis; stigma lateralis; vacuola contractilis 2 et 4 flagellum cellulae longiora apice; zygozoosporis cum 8 flagellum; movet porro; lg, 9–14 mi., lt. 9–12 mi. Hab. 2.

**3. PYRAMIDOMONAS ABDIDA sp. nov.** **Plate 1, fig. 3.**

Cellula cylindrica, parte anteriore abrupta, parte posterioreattenuata asymmetrica rotundata; membrana hyalina indistincta; chloroplast parietalis crassis in medio cellulae, granulata; parte posteriore longitudinaliter striata; nucleus in medio cellulae; pyrenoide nullo; 2 vacuola contractilis et 4 flagellum parte anteriore; lg. 15. 5 mi., lt. 7. 5 mi. Hab. 2.

**4. PYRAMIDOMONAS ABNATO sp. nov.** **Plate 1, fig. 4.**

Cellula elliptica, parte anteriora abrupta non undulata, lateribus rotundatis; parte posteriore modice attenuata et rotundata; sectione rotundata; membrana tenuissima; chloroplast parietalis cum pyrenoide centralis; stigma nullo; vacuola contractilis et 4 flagellum cellulæ longiora parte anteriore; lg. 15 mi. lt. 9 mi. Hab. 1.

**5. PYRAMIDOMONAS HYALINA sp. nov.** **Plate 1, fig. 5.**

Cellula fronte visa elliptico-ovalis, parte anteriore depressa, in medio et lateris papillata; lateribus fere parallela; parte late rotundata, in sectione rotundata; membrana indistincta, tenuissima, hyalina; chloroplast parietalis, crassis, homogenea viridis; pyrenoide I in parte posteriore; stigma nullo; nucleus in medio cellulae vacuola contractilis 2 apice; flagellum 4 cellulae; longiora; movet rapide; lg. 18 mi., lt. 11 mi. Affinis *Pyramidomonas abnato* sp. nov. Hab. 2.

**6. CARTERIA STRIATA sp. nov.** **Plate 1, fig. 6.**

(Sect. *Eucarteria* Pascher). Cellula subreni ormis, parte anteriore depressa, in medio modice concavæ; lateribus rotun-

data; parte posteriore modice attenuata et rotundata; membrana distincta, hyalina, punctato-striata; chloroplast parietalis; parte posteriore incrassata; nucleus in medio cellulae; pyrenoide elongata parte posteriore; vacuola contractilis parte anteriore; stigma nullo; flagellum 4, cellulae longiora; lg. et lt. 30 mi. Hab. 2.

**7. CARTERIA LACUSTRIS sp. nov.** **Plate 1, fig. 7.**

(Sect. *Eucarteria* Pascher). Cellula avalia, parte anteriore modice attenuata, parte posteriore late rotundata; membrana firma, hyalina; chloroplast parietalis, parte posteriore incrassata, parte mediano granulata; nucleus in medio cellulae; pyrenoide oblonga I, parte posteriore; vacuola contractilis 2 parte anteriore; stigma lateralis parte anteriora; flagellum 4 cellulae longiora; lg. 15 mi. lt. 12 mi. Affinis Carteria simplex Pascher, Hab 2.

**8. CARTERIA SINICA Skvortzow.** **Plate 1, fig. 8.**

*C. Sinica* Skvortzow: in Arch. Protist. 66 (1929) 160, fig. 1.

(Sect. *Tetramastix* Pascher). Cellula sphaerica; membrana firma, cytoplasma modice retracta; chloroplast parietalis, parte posteriore incrassatis; pyrenoide nullo; stigma elongata in medio lateralis; nucleus in medio cellulae; vacuola contractilis 2 apice; flagellum 4 cellulae longiora; papillo distincta; divisio cellulae longitudinalis; lg. 16 mi., lt. 8 mi. Hab. 2.

**9. CARTERIA OBOVATA sp. nov.** **Plate 1, fig. 9.**

(Sect. *Pseudaglae* Pascher). Cellula lato-obovata, parte anteriore depressa, parte posteriore rotundata; membrana hyalina, firma; chloroplast parietalis; nucleus et pyrenoide in medio cellulae; vacuola contractilis et flagellum 4 cellulae longiora parte anteriora; stigma elongata, lateralis; lg. 18 mi. Hab. 2.

**10. CARTERIA POLYCHLORIS Pascher.** **Plate 1, fig. 10.**

*C. Polychloris* Pascher in Volv. (1927) 156.

Cellula lg. 15. mi., lt. 11 mi. Hab. 2.

## Genus CHLAMYDOMONAS

### Sect. Euchlamydomonas

**11. CHLAMYDOMONAS BIARTICULATA sp. nov.** **Plate 1, fig. 12.**

Cellula late ovalis cum polis modico depressis; papillo nullo; membrana tenuissima, hyalina; cytoplasma late ovalis retractum ad apicem affixum; chloroplast parietalis; vacuola contractilis pone; stigma nullo; nucleus in medio cellulae; pyrenoide ovalis basalis; flagellum cellulae longiora; lg. 14 mi., lt. 11 mi. Hab. 2.

**12. CHLAMYDOMONAS BIFRONS sp. nov.** **Plate 1, fig. 13.**

Cellula late obovata, parte anteriore late rotundata, parte posteriore modice attenuata; papillo nullo; membrana tenuissima hyalina; cytoplasma late obovata retractum ad apicem affixem;

chloroplastae parietalis; vacuola contractilis pone; nucleus in medio cellulae; pyrenoide oblongum basalis; stigma nullo; lg. 18 mi., lt. 11 mi. Hab. 2.

**13. CHLAMYDOMONAS INVOLUCRATA sp. nov.** **Plate 1, fig. 14.**

Cellula sphaerica, papilla nullo; membrana tenuissima, hyalina; cytoplasma sphaerica retractum ad apicem affixem; chloroplastae parietalis; vacuola contractilis pone 2; nucleus in medio cellulae; pyrenoide ovalis basalis; stigma nullo; flagellum cellulae longiora; diam. 12 mi. Hab. 2.

**14. CHLAMYDOMONAS APICALA sp. nov.** **Plate 1, fig. 15.**

Cellula sphaerica vel fere sphaerica; papillo nullo; membrana tennuissima, hyalina; cytoplasma sphaerica retractum ad apicem affixem; chloroplastae parietalis; vacuola contractilis et stigma pone, nucleus in medio cellulae, pyrenoide oblongum basalis; flagellum cellulae longiora; diam. 16–22 mi., Hab. 2.

**15. CHLAMYDOMONAS PYRIFORMIS sp. nov.** **Plate 1, fig. 16.**

Cellula latae ovalis, parte anteriore acuta et rotundata, parte posteriore late rotundata; papillo nullo; membrana tenuissima, hylina; cytoplasma tetractum ad apicem affixem, late ovalis vel triquetrum; chloroplastae parietalis; vacuola contractilis pone, stigma nullo; nucleus in medio cellulæ; pyrenoide basalis, ovalis flagellum cellulae longiora; lg. 15 mi., lt. 9–12 mi. Hab. 2.

**16. CHLAMYDOMONAS PASCHERIANA (Skvortzow) nom. comb. nov.** **Plate 1, fig. 17.**

*Pteromonas Pacheri* SKVORTZOW in Arch.f. Hydrob. 18 (1927) 133–134, fig. 4.

Cellula sphaerica vel fere sphaerica; membrana hyalina, tenuissima; cytoplasma retractum ad medium cellulae affixem sphaerica vel late ovalis; vacuola contractilis pone 2; stigma juxta vacuola contractilis; pyrenoide basalis; flagellum cellulae longiora; nucleus in medio cellulae; lg. 22–23.5 mi. Hab. 2.

**17. CHLAMYDOMONAS SUBGLOBOSA Skvortzow.** **Plate 1, fig. 18.**

*C. subglobosa* SKVORTZOW in Arch. Protist. 66 (1929) 161, fig. 2.

Cellula elliptica, apicibus rotundatis; membrana firma; papillo minor; chloroplastae parietalis; pyrenoide et stigma basalis; nucleus in medio cellulae; flagellum cellulae longiora; lg. 15 mi., lt. 13 mi. Hab. 2.

**18. CHLAMYDOMONAS ASIATICA Skvortzow.** **Plate 1, fig. 19.**

*C. asiatica* SKVORTZOW in Species novae ... (1946) 14, Plate 1, fig. 31.

Cellula angustae-cylindrica, fronte et pone rotundata, lateribus parallelibus; papillo nullo; membrana distincta; chloroplastae

parietalis vacuola contractilis pone; nucleus in medio cellulae; pyrenoide rotundata in parte posteriore; flagellum cellulae longiora; lg. 18–21 mi., lt. 4–5 mi. Hab. prope Charbin in aquis stagnalis. 1931.

**19. CHLAMYDOMONAS PALUDOSA** Skvortzow. **Plate 1, fig. 20.**

*C. paludosa* SKVORTZOW in Arch. Protist. 66 (1929) 161, fig. 3.

Cellula late ovalis, parte anteriore attenuata et abrupta, parte posteriore late rotundata; papillo nullo; membrana firma; chloroplastæ parietalis modice retractum; vacuola contractilis non vidi; nucleus in medio cellulae; pyrenoide oblongum in parte posteriore; stigma lateralis; flagellum cellulae longiora; lg. 11 mi., lt. 8.5 mi. Hab. 2.

**20. CHLAMYDOMONAS OBLONGA sp. nov.** **Plate 1, fig. 21.**

Cellula elliptica, parte anteriore attenuatis, parte posteriore late rotundatis; membrana tenuissima; chloroplastae parietalis; vacuola contractilis 2, pone; nucleus in medio cellulae; pyrenoide rotundata; tergo; stigma nullo; flagellum cellulae longiora; lg. 7 mi., lt. 3 mi. Hab. 2.

**21. CHLAMYDOMONAS CONVEXA sp. nov.** **Plate 1, fig. 22.**

Cellula ovalis cum polis rotundatis; papillo et stigma nullo; membrana distincta; chloroplastae parietalis; vacuola contractilis in medio cellulae; pyrenoide oblonga in parte posteriore; flagellum cellulae longiora; lg. 15 mi., lt. 11 mi. Hab. 2.

**22. CHLAMYDOMONAS INFLATA sp. nov.** **Plate 1, fig. 23.**

Cellula ovalis vel late ovalis; papillo nullo; membrana tenuissima; chloroplastae parietalis; vacuola contractilis 2, pone; nucleus in medio cellulae; pyreniode tergo, rotundata; stigma nullo; flagellum cellulae longiora; lg. 5–14 mi., lt. 3–11 mi. Hab. 2.

**23. CHLAMYDOMONAS ARMATA sp. nov.** **Plate 1, fig. 24.**

Cellula sphaerica vel late ovalis, non papillata; membrana distincta; chloroplastae parietalis, granulata; vacuola contractilis pone, 2 in medio cellulae; stigma prope nucleus; pyrenoide magna, fere rotundata, parte posteriore; flagellum 1.5 cellulae longiora; lg. 11–15 mi., lt. 9–11 mi. Zygote sphaerica cum angulis acutis. Affinis *Chlamydomonas globosa* Snow. Hab. 3.

**24. CHLAMYDOMONAS LAEVE sp. nov.** **Plate 1, fig. 25.**

Cellula elliptica, apicibus rotundatis; papillo nullo; vacuola contractilis pone, 2; nucleus in medio cellulae; pyrenoide cylindricis fere parte posteriore; stigma elongata, lateralis; flagellum cellulae longiora; lg. 22 mi., lt. 14 mi. Hab. 2.

**25. CHLAMYDOMONAS COMPACTA sp. nov.** **Plate 1, fig. 26.**

Cellula sphaerica non papillata; membrana distincta; chloroplastae parietalis; nucleus in medio cellulae; vacuola contractilis 2, pone, stigma lateralis, parte anteriore; pyrenoide rotundata in parte posteriore; flagellum cellulae longiora; diam. 15 mi. Hab. 2.

**26. CHLAMYDOMONAS LIBERA sp. nov.** **Plate 1, fig. 27.**

Cellula late ovalis cum polis rotundatis; papillo nullo; membrana tenuissima; chloroplastae parietalis; nucleus in medio cellulae; flagellum lateralis; vacuola contractilis pone, 2; pyrenoide rotundata, parte posteriore, cellulae longiora; lg. 13 mi., lt. 11 mi. Hab. 2.

**27. CHLAMYDOMONAS BULLATA sp. nov.** **Plate 1, fig. 28.**

Cellula fere sphaerica, papillo nullo; membrana tenuissima, distincta; chloroplastae parietalis; vacuola contractilis 2, pone; nucleus centralis; pyrenoide parte posteriore, rotundata; flagellum cellulae longiora; lg. 11–15 mi., lt. 8–9 mi. Hab. 2.

**28. CHLAMYDOMONAS STIGMATA sp. nov.** **Plate 1, fig. 29.**

Cellula sphaerica non papillata; membrana distincta; chloroplastae parietalis; nucleus in medio cellulae; vacuola contractilis 2, pone; pyrenoide apice, rotundata; flagellum cellulae longiora; stigma bacilliformis; lg. et lt. 12–15 mi. Affinis *Chlamydomonas incerta* Pasch. Hab. 2.

**29. CHLAMYDOMONAS GRANULOSA sp. nov.** **Plate 1, fig. 30.**

Cellula sphaerica non papillata; membrana tenuissima; chloroplastae parietalis in medio garnulata; vacuola contractilis 2, pone nucleus in medio cellulae; pyrenoide ovalis in parte posteriore cum polis acutis; stigma pone; flagellum cellulæ longiora; lg. 14 mi. Hab. 2.

**30. CHLAMYDOMONAS LUNATA sp. nov.** **Plate 1, fig. 31.**

Cellula sphaerica non papillata; membrana rigida; chloroplastae parietalis; nucleus in medio cellulae; vacuola contractilis pone; pyrenoide semilanata parte posteriore; stigma nullo; flagellum cellulae longiora; diam. 22.

**31. CHLAMYDOMONAS AMPULLA sp. nov.** **Plate 1, fig. 32.**

Cellula sphaerica non papillata; membrana distincta; vacuola contractilis parte anteriore, 2; nucleus in medio cellulae; chloroplastae parietalis; pyrenoide elongata, asymmetrica, parte posteriore; stigma parte anteriore, distincta; flagellum cellulae longiora; lg. et lt. 25–30 mi. Hab. 2.

**32. CHLAMYDOMONAS FRANKI Pascher.** **Plate 1, fig. 33.**

*C. Franki* PASCHER in Volv. (1927) 222, fig. 167.

Cellula elongata-ovalis, apicibus rotundatis; papillo distincta; membrana rigida; vacuola contractilis pone; stigma nullo; nucleus in medio cellulae; pyrenoide parte posteriore; flagellum cellulae longiora; lg. 15 mi., lt. 11 mi. Hab. 2.

**33. CHLAMYDOMONAS CAVA sp. nov.** **Plate 1, fig. 34.**

Cellula late ovalis, papillata, apicibus rotundatis; membrana tenuissima, hyalina; Chloroplastæ parietalis, crassa; vacuola contractilis 2, pone; stigma nullo; nucleus in medio cellulae; flagellum cellulae longiora; lg. 15–22 mi., lt. 11–18 mi. Affinis *Chlamydomonas Franki* Pasch. Hab. 2.

**34. CHLAMYDOMONAS PRINTZII sp. nov.** **Plate 1, fig. 35.**

Cellula ovalis, apicibus rotundatis; papillo distincta; membrana tenuissima; Chloroplastae parietalis; vacuola contractilis 2, parte anteriore; nucleus in medio cellulae; stigma pone; flagellum cellulae longiora; lg. 15 mi., lt. 11 mi. Affinis *Chlamydomonas Showiae* Printz. Dedicavit hanc species Prof. H. Printz, Oslo, Norvege. Hab. 2.

**35. CHLAMYDOMONAS PARALLELISTRIATA Korschikoff.** **Plate 1, fig. 36.**

*C. parallelistriata* Korschikoff in PASCHER, Volv. (1927) 235–236, fig. 185.

*C. tuberosa* SKVORTZOW in Species novae . . . (1946) 14, Plate 1, fig. 27.

Cellula sphaerica ad apicem papillis instructa; membrana firma, non lamellosa; Chloroplastae parietalis, striata et crassa; pyrenoide elongata, parte posteriore; nucleus in medio cellulae; vacuola contractilis 2; stigma pone; fl. cellulae longiora; membrana firma non lamellosa; lg. 18 mi., lt. 17 mi; Hab. aquis stagnalis prope Charbin. 3/7/37.

**Sect. Aglœ**

**36. CHLAMYDOMONAS ERECTA sp. nov.** **Plate 1, fig. 37.**

Cellua elliptica, apicibus rotundatis; papillo nullo membrana tenuissima; chloroplastae H-formiae, granulata; vacuola contractilis pone; nucleus et pyrenoide in medio cellulae; stigma prope nucleus; flagellum cellulae longiora; lg. 14 mi., lt. 7 mi. Hab. 2.

**37. CHLAMYDOMONAS TUMIDA Skvortzow.** **Plate 1, fig. 38.**

*C. tunida* SKVORTZOW in Species novae . . . (1946) Plate 2, fig. 21.

Cellula elliptica, fronte et pone rotundata; membrana tenuissima; papillo nullo; chloroplastae H-formiae, marginibus lobatis; pyrenoide et nucleus centralis; lg. 15–17 mi., lt. 5–6 mi. Hab. in aquis stagnalis prope Charbin. 1931.

**38. CHLAMYDOMONAS DANGEARDI sp. nov.** **Plate 1, fig. 39.**

Cellula ovalis; membrana crassa; papillo minor, distincta; chloroplastae H-formiae; vacuola contractilis 2, pone; pyrenoide et nucleus contralis; stigma nullo; flagellum 1.2 cellulae longiora. Affinis *Chlamydomonas Dangeardi* Chmil. Hab. 2.

**39. CHLAMYDOMONAS OCELLATA** Skvortzow. **Plate 1, fig. 40.**

*C. ocellata* SKVORTZOW in Species novae . . . (1946) Plate 1, figs. 28, 29.

Cellula elliptica vel ovalis, fronte et pone rotundata, papillata; membrana crassa; chloroplastae H-formiae; pyrenoide centralis; nucleus prope pyrenoide; vacuola contractilis et stigma pone; flagellum cellulae longiora; lg. 15–18 mi., lt. 9–10 mi. Hab. 2.

**40. CHLAMYDOMONAS PROLIFERA sp. nov.** **Plate 1, fig. 41.**

Cellula sphaerica non papillata; membrana tenuissima; hyalina; chloroplastae parietalis, granulata; vacuola contractilis 2, pone; nucleus et pyrenoide in medio cellulae; stigma bacilliformis, prope nucleus; flagellum cellulae longiora; diam. 18.5 mi. Hab. 2.

**41. CHLAMYDOMONAS DILATATA sp. nov.** **Plate 1, fig. 42.**

Cellula ovalis cum apicibus rotundatis; papillo nullo; membrana distincta; Chromatophora discoidea; vacuola contractilis 2 et stigma pone; nucleus et pyrenoide centralis; flagellum 1.5 cellulae longiora; lg. 25 mi., lt. 14 mi. Affinis *Chlamydomonas stellata* Dill. Hab. 2.

**42. CHLAMYDOMONAS BURSICULÆFORMIS sp. nov.** **Plate 1, fig. 43.**

Cellula late ovalis vel triquetris; membrana tenuissima; chloroplastae parietalis, dilute; papillo nullo; vacuola contractilis pone; nucleus et pyrenoide contralis; flagellum cellulae longiora; lg. 3–9 mi., lt. 3–7 mi. Hab. 2.

**43. CHLAMYDOMONAS OBLIQUA sp. nov.** **Plate 1, fig. 44.**

Cellula fronte elliptica, latere visa modice curvata, apicibus rotundatis; chloroplastae parietalis; vacuola contractilis 2, pone; nucleus et pyrenoide centralis; flagellum cellulae longiora; lg. 11 mi., lt. 7 mi. Hab. 2.

**44. CHLAMYDOMONAS RECTA sp. nov.** **Plate 1, fig. 45.**

Cellula elliptica, apicibus rotundatis; papillo nullo; membrana rigida; chloroplastae H-formiae; vacuola contractilis pone; nucleus et pyrenoide centralis; stigma nullo; flagellum cellulae longiora; lg. 18 mi., lt. 7 mi. Affinis *Chlamydomonas pulchra* Skv. Hab. 2.

**45. CHLAMYDOMONAS PULCHRA Skvortzow.** **Plate 1, fig. 46.**

*C. pulchra* Skvortzow in Arch. Proist. 66 (1929) 161–162, fig. 5.

Cellula late ovalis, apicibus rotundatis; membrana distincta; chloroplastae H-formiae, utrimque nucleus longitudinaliter divisa; vacuola contractilis pone; stigma nullo; nucleus et pyrenoide in medio cellulae; flagellum cellulae longiora; lg. 14 mi., lt. 11 mi. Hab. 2.

Subgenus CHLAMYDELLA

**46. CHLAMYDOMONAS FLUVIALIS sp. nov.** **Plate 1, fig. 47.**

Cellula fronte elongato-elliptica, parte anteriore angustior partis posteriore; latere visa modice curvata et obliqua; membrana tenuissima; stigma et papillo nullo; chloroplastae lamillifera; pyrenoide et nucleus centralis; vacuola contractilis pone; flagellum cellulae longiora; lg. 3.2–9.2 mi., lt. 1.5–3.3 mi. Hab. 2.

**47. CHLAMYDOMONAS MICROSCOPIA G. S. West.** **Plate 1, fig. 48.**

*C. microscopia* G. S. West in Pascher, Volv. (1927) 274, fig. 232.

Cellula lanceolata, apicibus acutis; membrana tenuissima; papillo nullo; chloroplastae parietalis, dilute; nucleus et pyrenoide centralis; stigma nullo; flagellum cellulae longiora; lg. 5 mi., 2.5 mi. Hab. 2.

Sect. Chlorogoniella

**48. CHLAMYDOMONAS MANSHURICA Skvortzow.** **Plate 1, fig. 49.**

*C. manshurica* Skvortzow in Arch. Protist 66 (1929) 162, fig. 6

Cellula elliptica, apicibus rotundatis; membrana crassa; papillo et stigma nullo; chromatophora lamillifera lacerata; nucleus in medio cellulae; pyrenoide centralis cum granulis amylaceis radiatis; vacuolo contractilis non vidi; flagellum cellulae longiora; lg. 16 mi., lt. 11 mi. Hab. 2.

**49. CHLAMYDOMONAS CISTULA sp. nov.** **Plate 1, fig. 50.**

Cellula elongato-ovalis, parte anteriore acuta; papillo nullo; parte posteriore rotundata; membrana distincta; chloroplastae lateralis; vacuola contractilis 2, pone; nucleus et pyrenoide centralis flagellum cellulae longiora; lg. 12 mi., lt. 7 mi. Affinis *Chlamydomonas Kuteinikowi* Gorosh. et *C. ovalis* Pascher. Hab. 2.

**50. CHLAMYDOMONAS MINOR sp. nov.** **Plate 1, fig. 51.**

Cellula elliptica, apicibus rotundatis; papillo nullo; membrana tenuissima; chloroplastae lateralis; nucleus et pyrenoide mediana; vacuola contractilis et stigma non vide; flagellum cellulae, longiora; lg. 11 mi., lt. 5 mi. Affinis *Chlamydomonas dinobryonis* G. M. Smith. Hab. 2.

**51. CHLAMYDOMONAS PHASEOLUS Skvortzow.** **Plate 1, fig. 11.**

*C. phaseolus* Skvortzow in Arch. Protist. 66 (1929) 161, fig. 4.

Cellula elliptica, non papillata; membrana tenuissima; chloroplast parietalis, granulata; nucleus in medio cellulae; pyrenoide lateralis in medio cellulae; vacuola contractilis et stigma pone; flagellum cellulae longiora; lg. 11 mi., lt. 6. 5 mi. Hab. 2.

Subgenus PLEIOCHLORIS

**52. CHLAMYDOMONAS SHAWI Skvortzow.** **Plate 1, figs. 52, 53.**

*C. Shawi* Skvortzow in Arch. Protist. 66 (1929) 162, fig. 7.

*C. sungariensis* Skvortzow in Species novae . . . (1946) Plate 1, fig. 30.

Cellula late ovalis, parte anteriore acutis, parte posteriore late rotundatis; membrana firma non papillata; chloroplastae parietalis; vacuola contractilis pone; nucleus et stigma fere centralis; pyrenoide 3–4; flagellum 1–1.5 cellulae longiora; lg. 15 mi., lt. 12 mi. Hab. 2.

**53. CHLAMYDOMONAS FOVEOLATA sp. nov.** **Plate 1, fig. 54.**

Cellula elongato-ovalis, pone attenuata; membrana tenuissima; chloroplastae parietalis; vacuola contractilis pone; papillo distincta; nucleus in medio cellulae; pyrenoide 5–8; stigma nullo; flagellum 1.2 cellulae longiora; lg. 9 mi., lt. 5 mi. Hab. 2.

Subgenus CHLOROMONAS

**54. CHLAMYDOMONAS OVATA Dangeard.** **Plate 1, fig. 55.**

*C. ovata* Dangeard in Pascher, Volv. (1927) 277–278, fig. 236.

Cellula late lanceolata, apicibus acutis; membrana tenuissima; papillo minor; chloroplastae lamillifera; nucleus in medio cellulae; pyrenoide nullo; stigma prope nucleus; flagellum cellulae longiora; lg. 11 mi., lt. 5 mi. Hab. 2.

**55. CHLAMYDOMONAS PAPILLATA sp. nov.** **Plate 1, fig. 56.**

Cellula ovalis cum polis rotundatis; papillo distincta; membrana firma; chloroplastae parietalis; vacuola contractilis 2 et stigma pone; nucleus in medio cellulae; pyrenoide nullo; flagellum cellulae longiora; lg. 14–15 mi., lt. 8–9 mi. Hab. 2.

**56. CHLAMYDOMONAS BACCATA sp. nov.** **Plate 1, fig. 57.**

Cellula late ovalis; pone papillata; membrana crassa; chloroplastae granulata, granulis majoris; vacuola contractilis pone; stigma et pyrenoide nullo; nucleus in medio cellulae; flagellum cellulae longiora; lg. 18 mi., lt. 13 mi. Hab. 2.

**57. CHLAMYDOMONAS AREOLATA sp. nov.** **Plate 1, fig. 58.**

Cellula elliptica cum polis rotundatis; membrana crassa; papillo distincta; chromatophora granulata, granulis numerosis; vacuola contractilis et stigma a tergo; nucleus in medio cellulae;

pyrenoide nullo; flagellum cellulae longiora; lg. 18 mi., lt. 11 mi. Hab. 2.

**58. CHLAMYDOMONAS FRAGILIS sp. nov.** **Plate 1, fig. 59.**

Cellula ovalis cum polis rotundatis; papillo et stigma nullo; membrana crassa; chromatophora divisa, granulata; granulis forma variae; nucleus in medio cellulae; flagellum cellulae longiora; lg. 18 mi., lt. 10 mi. Hab. 2.

**59. CHLAMYDOMONAS STAGNALIS Skvortzow.** **Plate 1, fig. 60.**

*C. stagnalis* Skvortzow in Arch. Protist. (1929) 162, fig. 9.

Cellula sphaerica, papillo nullo; membrana crassa; chromatophora disceidea, numerosa; nucleus in medio cellulae; stigma prope nucleus; pyrenoide nullo; flagellum cellulae longiora; lg. et lt. 19 mi. Hab. 2.

**60. CHLAMYDOMONAS ABBREVIATA sp. nov.** **Plate 1, fig. 61.**

Cellula sphaerica non papillata; membrana rigida; chromatophora granulata; vacuola contractilis et stigma tergo; nucleus in medio cellulae; pyrenoide nullo; flagellum 1.5 cellulae longiora; diam. cellulae 18–19 mi. Hab. 2.

**61. CHLAMYDOMONAS SOLIDA Skvortzow.** **Plate 1, fig. 62.**

*C. solida* Skvortzow in Species novae . . . (1946) 14, Plate 1, fig. 32.

Cellula sphaerica, fronte rotundata, pone leviter conica, non papillata; membrana crassa; chromatophora granulata, viridia; stigma et pyrenoide nullo; nucleus in medio cellulae; flagellum cellulae longiora; lg. 20.4 mi., lt 18.7 mi. Hab. 2.

**62. CHLAMYDOMONAS PLENA sp. nov.** **Plate 1, fig. 63.**

Cellula fere sphaerica, late ovalis non papillata; membrana tenuissima; chromatophora maculata; vacuola contractilis et stigma pone; nucleus in medio cellulae; pyrenoide nullo; lg. 5–7 mi., lt. 3–4 mi. Hab. 2.

**63. CHLAMYDOMONAS PROTRACTA sp nov.** **Plate 1, fig. 64.**

Cellula elongata ovalis cum polis rotundatis; papillo et pyrenoide nullo; chloroplastae parietalis, maculata; vacuola contractilis et stigma pone; nucleus in medio cellulae; flagellum cellulae longiora; lg. 7.4 mi., lt. 1 mi. Affinis *Chlamydomonas maculata* Playf. Hab. 2.

**64. CHLAMYDOMONAS MACULATA Playfair.** **Plate 1, fig. 65.**

*C. maculata* Playfair in Pascher, Volv. (1927) 292–293, fig. 257.

Cellula elliptica apicibus rotundatis; membrana firma; chloroplastae parietalis, maculata; pyrenoide nullo; vacuola contractilis pone; stigma prope nucleus; flagellum cellulae longiora; lg. 15 mi., lt. 5 mi. Hab. 2.

**65. CHLAMYDOMONAS ÆSTIVATA sp. nov.** **Plate 1, fig. 66.**

Cellula elongato-elliptica, pone acutis; membrana tenuissima; chloroplastae parietalis; vacuola contractilis et stigma pone; nucleus medio cellulae; pyrenoide nullo; flagellum 1.5 cellulae longiora; lg. 15 mi., lt. 5–6 mi. Hab. 2.

**66. CHLAMLDOMONAS FRITSCHI Skvortzow.** **Plate 1, fig. 67.**

*C. Fritschi* Skvortzow in Arch. Protist. 66 (1929) 162, fig. 8.

Cellula sphaerica, parte anteriore acutis; papillo nullo; membrana crassa; chloroplastae parietalis; vacuola contractilis pone; stigma inter nucleus vacuola contractilis; nucleus in medio cellulae; pyrenoide nullo; flagellum cellulae longiora; lg. 17 mi. Hab. in aquis stagnalis prope Charbin. 1927.

**67. CHLAMYDOMONAS MULTIPLEX sp. nov.** **Plate 1, fig. 68.**

Cellula ovalis, papillo nullo; membrana rigida; chloroplastae parietalis; cytoplasma in parte posteriore retractum; vacuola contractilis pone; stigma et pyrenoide nullo; nucleus in medio cellulae; flagellum cellulae longiora; lg. 15 mi., It. 8 mi. Affinis *Chlamydomonas Westiana* Pasch. Hab. 2.

**68. CHLAMYDOMONAS SUPERIORA sp. nov.** **Plate 2, fig. 1.**

Cellula elliptica, apicibus rotundatis; papillo nullo; chloroplastis parietalis; vacuola contractilis et stigma pone; nucleus in medio cellulae; pyrenoide nullo; cytoplasma parte posteriore modice retractum; flagellum cellulae longiora; lg. 30 mi., lt. 14 mi. Hab. 2.

**69. CHLAMYDOMONAS DISSIMILIS sp. nov.** **Plate 2, fig. 2.**

Cellula elliptica, parte anteriore acuta, non papillata; parte posteriore a abrupto-rotundata; membrana firma; cytoplasma parte posteriore rectractum; vacuola contractilis pone; stigma et pyrenoide nullo; nucleus in medio cellulae; flagellum cellulae longiora; lg. 15 mi., lt. 7 mi. Hab. 2.

**70. CHLOROGONIUM OBLIQUUM Skvortzow.** **Plate 2, fig. 3.**

*C. obliquum* Skvortzow in Species novae . . . (1946) Plate 1, fig. 44.

Cellula elongata, inaequilateralia ventre recta, dorso rotundata, apicibus rotundatis; chloroplastae parietalis; nucleus fere centralis; pyrenoide propter nucleus; flagellum 2, apice, ⅔ cellulae longiora; vacuola contractilis pone, papillo nullo; lg. 25 mi., lt. 7 mi. Hab. 2.

**71. CHLOROGONIUM ACUTISSIMUM sp. nov.** **Plate 2, fig. 4.**

Cellula acutissima, parte anteriore et parte posteriore filiformibus; flagellum apice, ½ cellulae longiora; cellula longiora 10–14 quam latis; chloroplastae parietalis; pyrenoide nullo;

nucleus medio cellulae; vacuola contractilis 2 juxta apicem; stigma apice; flagellum 2⅔ cellulae longiora; lg. 44 mi., lt. 5–6 mi. Hab. 2.

**72. CHLOROGONIUM TENUISSIMUM sp. nov.** **Plate 2, fig. 5.**

Cellula tenuissima, gracillimae linearia; cellula longiora 20–45 quam latis lateribus cellulae parallelis vel modice arcuatis; chloroplastae parietalis; nucleus in medio cellulae; pyrenoide 3–8 longitudinaliter dispositis; vacuola contractilis 2 juxta apicem; stigma parte apicale; flagellum 2, 4–5 plo cellulae brevior; lg. 80–129 mi., lt. 4–6 mi. Hab 2.

**73. CHLOROGONIUM VERNALE sp. nov.** **Plate 2, fig. 6.**

Cellula lanceolata, apicibus attenuatis, acutis et hyalinis; nucleus medio cellulae; chloroplastae parietalis; nucleus medio cellulae; stigma inter nucleus et apice; vacuola contractilis 2; flagellum non vidi; pyrenoide nullo; lg. 55 mi., lt. 12 mi. Hab. 2.

**74. CHLOROGONIUM ACUMINATUM sp. nov.** **Plate 2, fig. 7.**

Cellula lanceolata, parte anteriore acuminata, parte posteriore longe caudata, longiora cellulae 4–5 quam latis; flagellum papillo longa; chlorophora parietalis; pyrenoide 1–2 centralis vel supra medium posito; nucleus in medio cellulae; vacuola contractilis 2, apice; stigma juxta apicem; flagellum 2, cellulae longiora vel 0.5 longius; lg. 25–51 mi., lt. 4–8 mi. Hab. 2.

**75. CHLOROGONIUM MINUTUM sp. nov.** **Plate 2, fig. 8.**

Cellula lanceolata, parte anteriore abrupta, parte posteriore attenuata vel acuminata; cellula longiora 3–4 plo brevioribus quam latis; flagellum papilla distincta; chloroplastae parietalis; pyrenoide centralis; nucleus in medio cellulae; stigma nullo; vacuola contractilis 2, apice; flagellum 2 cellulae longiora; lg. 11 mi., lt. 4–5 mi. Hab. 2.

**76. SPHÆROLLEPSIS OVALIS sp. nov.** **Plate 2, fig. 9.**

Membrana hyalina, tenuissima; cellula ovata, apicibus rotundatis; cytoplasma pyriformis, elongata, parte anteriore attenuata et acuta, parte posteriore rotundata, retractum, parte anteriore affixum; chloroplastae parietalis; pyrenoide 1, parte posteriore; nucleus in medio cellulae; vacuola contractilis 2; stigma inter nucleus et parte anteriore; flagellum 2 cellulae longiora; lg. 22 mi., lt. 18 mi. Hab. 2.

**77. SPHÆROLLOPSIS ELONGATA sp. nov.** **Pate 2, fig. 10.**

Membrana hyalina; cellula cylindrica, apicibus rotundatis, lateribus modice concava; cytoplasma oblonga, retractum et parte anteriore affixem; chloroplastae parietalis; pyrenoide 1,

parte posteriore; stigma juxta apicem; vacuola contractilis 2; nucleus in medio cellula; flagellum 2 cellulae longiora; lg. 26 mi., lt. 11 mi. Hab. 2.

**78. SPHÆROLLOPSIS ASIATICA sp. nov.** **Plate 2, fig. 11.**

Membrana hyalina; cellula oblong-elliptica, apicibus rotundatis; cytoplasma lanceolata, lateralis retractum, parte anteriore et posteriore cellulae affixem; chloroplastae parietalis; pyrenoide centralis; nucleus in medio cellulae; vacuola contractilis 2; flagellum 2 cellulae longiora; lg. 15 mi., lt. 9 mi. Hab. 2.

**79. THORAKOMONAS KORSCHIKOVI sp. nov.** **Plate 2, fig. 12.**

Membrana nigro-brunnea, granulata; cellula ovalia, marginis irregulariter undulatis, parte anteriore acutis, parte posteriore undulatis; cytoplasma formam cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide, parte posteriore; nucleus in medio cellulæ; vacuola contractilis pone; stigma juxta apicem; flagellum 2 cellulae longiora; lg. 15 mi., lt. 9 mi. Hab. 2. Dedico hanc species ad memoriam Prof. A. Korschikov, Charkow, URSS.

**80. THORAKOMONAS QUADRATA sp. nov.** **Plate 2, fig. 13.**

Membrana brunnea, hyalina; cellula obovata, parte anteriore late rotundata, parte posteriore cuneata, apice rotundata; cytoplasma cellulae retractum; chloroplastae parietalis; pyrenoide 1, parte posteriore; nucleus in medio cellulae; vacuola contractilis pone; flagellum cellulae longiora; latere visa oblonga, vertice quandrangulata; lg. 11 mi., lt. 7 mi. Hab. 2.

**81. THORAKOMONAS ASIATICA sp. nov.** **Plate 2, fig. 14.**

Membrana robusta, brunnea, verrucosa; cellula ovata, apicibus rotundata; cytoplasma ovata et retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyreniode 1, centralis; nucleus in medio cellulae; stigma juxta apicem; vacuola contractilis 2; flagellum 2 cellulae longiora; latere et vertice visa depresso rectangularis; lg. 11 mi., lt. 7 mi. Hab. 2. *Thorakomonas sabulosa* Korsch. affinis, differt cytoplasma retractum ad cellulae.

**82. THORAKOMONAS OBOVATA sp. nov.** **Plate 2, fig. 15.**

Membrana robusta, brunnea, verrucosa; cellula obovata, parte anteriore acuta non papillata, parte posteriore late rotundata; cytoplasma obovata non retractum; chloroplastae parietalis, granulata; pyrenoide 1 parte posteriore; nucleus in medio cellulae; stigma juxta apicem; vacuola contractilis 2, flagellum 2

cellulae longiora, latere et vertice visa depressa fere rectangularis; lg. 11 mi., lt. 8 mi. Hab 2. Affinis *Thorakomonas sabulosa* Korsch., differt formam cellulae.

**83. LOBOMONAS ROSTRATA Hazen.** **Plate 1, fig. 16.**

Stigma nullo. Hab. 2.

**84. DIPLOSTAURON PHACUS sp. nov.** **Plate 2, fig. 17.**

Membrana hyalina, firma; cellulae fronte visa depresso-orbicularis, apicibus acutis, papillatis, lateribus arcuatis; cytoplasma formam cellulae non retractum; chloroplastae parietalis; pyrenoide numerosis; nucleus in medio cellulae; vacuola contractilis 2; flagellum 2; stigma non visa; vertice visa quadrata; lg. et lt. 18 mi. Hab. 2.

**85. VISLOUCHIELA PLANCTONICA Skvortzow.** **Plate 2, fig. 46.**

*V. planctonica* SKVORTZOW in Proc. Sung. River Biol. St. 1 (1925), ibid. Arch. Hydrob. 18 (1927) 134, figs. 7, 8.

Cellula fronte visa sphaerica, latere visa depressa, anteriore bispinosa, parte posteriore 3 spinosa; membrana firma brunnea, verrucosa; cytoplasma ovalis; chloroplastae parietalis; vacuola contractilis et stigma pone; pyrenoide et nucleus in medio cellulae; flagellum 2 cellulae longiora; lg. 25–29 mi., lt. 19.5–21 mi. Hab. 2.

## COCCOMONADINEÆ

*Clevis generis Coccomonadineæ*

1. Flagellum 2, testa elliptica, orbicularis vel cordiformis.
   a. Flagellum porus 1.
      b. Cellula fronte et latere similis ..... *Coccomonas* Stein.
      b. b. Cellula fronte et latere non similis ..... *Arnoldiella* gen. nov.
   a. a. Flagellum porus 2 ..... *Dysmorphococcus* Takeda.
1. 1. Flagellum 4.
   a. Testa fronte visa ovalia, latere depressa ..... *Pedinopera* Pascher.
   a. a. Testa latere non depressa ..... *Gordejeviella* gen. nov.

**86. COCCOMONAS PLANCTONICA Skvortzow.** **Plate 2, fig. 18.**

*C. planctonica* SKVORTZOW in Arch. Hydrob. 18 (1927) 133, fig. 1.

Membrana nigro-brunnea, hyalina; cellula rotundata; cytoplasma rotundata, non retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide 1; nucleus non vidi; stigma juxta apicem; vacuola contractilis indistinctis; flagellum 2, cellulae longiora; lg. 14.8–16 mi. Hab. in aquis stagnalis prope Charbin.

**87. COCCOMONAS CORDIFORMIS Skvortzow.** **Plate 2, fig. 19.**

*C. cordiformis* SKVORTZOW in Arch. Hydrob. 18 (1927) 133, fig. 3.

Membrana firma, brunnea; cellula cordiformis, parte anteriore concavae, lateribus rotundatis, parte posteriore modice attenua-

tis et. rotundatis; cytoplasma ovata, retractum et parte anteriore affixem; chloroplastae parietalis; pyrenoide 1 centralis; stigma juxta pyrenoide; vacuola contractilis non vidi; flagellum cellulae longiora; lg. et lt. 18–19 mi. Hab. in aquis stagnalis prope Charbin.

**Genus ARNOLDIAMONAS novum**

Membrana firma, brunnea, hyalina; cellula fronte visa ovalia, orbicularis vel elongata, later compressa vel triangulata; cytoplasma orbiculata vel elongata; chloroplastae parietalis; pyrenoide 1 vel absent; nucleus in medio cellulae; vacuola contractilis 2; flagellum 2 cellulae longiora. Affinis generis *Coccomonas* Stein, differt cellulae latere compressa vel triangulata. Dedico hanc generis ad memoriam Prof. V. Arnoldi, algologo, Charkow, URSS.

**88. ARNOLDIAMONAS BISPINOSA sp. nov.** **Plate 2, fig. 20.**

Membrana hyalina, brunnea; cellulae orbiculata, parte anteriore depressa, 1; lateribus rotundatis, parte posteriore rotundata, spinis 2 minoris instructis; cytoplasma orbiculata, retractum ad cellulae parte anteriore affixem; chloroplastae parietalis, granulata; pyrenoide non vidi; stigma juxta apicem; vacuola contractilis 2; nucleus in medio cellulae, latere visa pyriformis, apicibus rotundatis; lg. 15 mi., lt. 12 mi. Hab. 2.

**89. ARNOLDIAMONAS OCELLATA sp. nov.** **Plate 2, fig. 21.**

Membrana firma nigro-brunnea, hyalina; cellula cordiformis, parte anteriore depressa, lateribus rotundatis, parte posteriore modice attenuata et late rotundata; cytoplasma rotundata non ovalia, retractum ad cellulae parte anteriore affixum, chloroplastae parietalis; pyrenoide 1, centralis; nucleus in medio cellula; stigma juxta apicem; vacuola contractilis 2; flagellum 2 cellulae longiora; latere visa fere triangulata, angulis rotundatis; lg. et lt. 15 mi. Hab. 2. A *Arnoldiella compressa* sp. nov. affinis, differt cytoplasmae rotundatis et stygmatis.

**90. ARNOLDIAMONAS COMPRESSA nom. nov.** **Plate 2, fig. 22.**

*Pteromonas compressa* Skvortzow in Arch. Hydrob. 18 (1927) 133–134, fig. 5, 9.

**91. ARNOLDIELLA PHASEOLUS sp. nov.** **Plate 2, fig. 23.**

Membrana brunnea, firma et hyalina; cellula elliptica, parte anteriore late rotundata, parte posteriore modice attenuata vel rotundata; cytoplasma oblonga, apicibus attenuatis, parte anteriore cellulae affixem; chloroplastae parietalis; pyrenoide 1

centralis; vacuola contractilis 2; nucleus in medio cellulae; flagellum 2 cellulae longiora; latere visa reniformibus, vertice ovata; lg. 18 mi., lt. 11 mi. Hab. 2.

**92. PEDINOPTERA NADSONI** Skvortzow. **Plate 2, fig. 24.**

*P. Nadsonii* Skvortzow in Arch. Protist. 66 (1929) 162.

*Pyradinomonas nadsonii* Skvortzow in Beich. Bot. Centralb. 16 (1925) 314, fig. 5.

Membrana hyalina partem granulata; cellula fronte visa ovata, parte anteriore abrupta, lateribus rotundata et granulata, parte posteriore late rotundata et non granulata; cytoplasma retractum; chloroplastae parietalis non contracta; nucleus in medio cellulae; pyrenoide fere centralis; stigma fere centralis; vacuola contractilis non vidi; flagellum 4 cellulae longiora; lg. 18.5–19 mi., it. 14.8–15.2 mi. Hab. Manshuria borealis, in stagnum prope Tailaischo stationem.

**Genus GORDEJEVIELLA novum**

[*Carteria* pro parte, sensu Skvortzow.]

Membrana nigro-brunnea, firma; cellula cordiformis, parte anteriore concavae, lateribus retundatis, parte posteriore attenuata et rotundata; cytoplasma ovata, retractum, parte anteriore affixem; chloroplastae parietalis; pyrenoide 1, rotundata; stigma juxta aspicem; vacuola contractilis indistinctis; flagellum 4 cellulae longiora, latere visa non depressa. Dedico hanc generis T. Gordejev, botanico, Charbin.

**93. CORDEJEVIELLA NIGRA nom. nov.** **Plate 2, fig. 25.**

*Carteria nigra* Skvortzow in Arch. Hydrob. 18 (1927) 133–134, fig. 6.

Cellula lg. 18.5–19 mi., lt. 15.5–16 mi. Hab. 2.

## PHACOTACEÆ

**94. PHACOTUS HYALINA sp. nov.** **Plate 2, fig. 26.**

Membrana hyalina et firma; cellula fronte visa rotundata, latere visa lanceolata, apicibus acutis; cytoplasma minor, rotundata, parte anteriore affixem; chloroplastae parietalis; pyrenoide apice; vacuola contractilis 2; flagellum cellulae longiora; nucleus centralis; diam. 11–12 mi. Hab. 2.

**95. PHACOTUS ASIATICUS sp. nov.** **Plate 2, fig. 27.**

Membrana hyalina non brunnea, minutae granulata, cellula fronte visa rotundata; cytoplasma rotundata, minor, parte anteriore affixem; chloroplastae parietalis; pyrenoide 1 apice; vacuola contractilis et stigma non visa; flagellum 2 cellulae longiora; cellula latere visa ovata, apicibus rotundatis, non acutis; lg. 15–18 mi. Hab. 2.

**96. PHACOTUS OBLONGUS sp. nov.** **Plate 2, fig. 28.**

Membrana brunnea et modice verrucosa; cellula late ovata, parte anteriore recta, lateribus rotundatis; cytoplasma elongata et retractum ad cellulae parte anteriore affixem chloroplastae parietalis; pyrenoide nullo; nucleus in medio cellulae; stigma juxta apicem; vacuola contractilis 2; flagellum 2 cellulae longiora; cellula latere visa elongata, vertice ovata cum apicibus attenuatis; lg. 15 mi. Hab. 2.

**97. PTEROMONAS FOLIOSA sp. nov.** **Plate 2, fig. 29.**

Cellula fronte visa obovata, parte anteriore late rotundata, lateribus rectis fere parallelis, parte posteriore longa attenuata et acuta; membrana hyalina, firma; cytoplasma orbicularis, retractum ad fronte parte anteriore affixem; chloroplastae parietalis; pyrenoide et nucleus centralis; stigma juxta apicem; vacuola contractilis 2, apice; flagellum 2 cellulae longiora; papillo distincta; latere visa lanceolata, vertice ovata, apicibus cum spinis rectis; lg. 26 mi., lt. 18 mi. Hab. 2.

**98. PTEROMONAS TRIGUSTRA sp. nov.** **Plate 2, fig. 30.**

Cellula fronte visa fere rotundata, parte anteriore conice, lateribus arcuatis, parte posteriore recta, 3 undulata; membrana hyalina, firma; cytoplasma ovalia, fronte rotundata, apice acuta, retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide 4; nucleus centralis; stigma juzta apicem; vacuola contractilis 2 apice; flagellum 2 cellulae longiora; latere et vertice visa ovalis, lateribus incisa, apicibus spinis recurvis; lg. 15 mi. lt. 11 mi. Hab. 2.

**99. PTEROMONAS CYLINDRICA sp. nov.** **Plate 2, fig. 31.**

Cellula fronte visa fere cylindrica, parte anteriore recta, compressa, angulis rotundatis; papillo nullo; membrana hyalina, rigida; cytoplasma oblonga, lateribus rugosis et compressis, retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; stigma et flagellum 2 cellulae longiora parte anteriore; vacuola contractilis 2, apice; latere et vertice visa oblonga vel ovata, lateribus incisis, apicibus cum spinis recurvatis; lg. 18 mi, lt. 7.5 mi. Hab. 2.

**100. PTEROMONAS RHOMBICA sp. nov.** **Plate 2, fig. 32.**

Cellula fronte rhomboides, parte anteriore truncata, non papillata, parte posteriore rotundata, lateribus angulatis; chloroplastae parietalis; flagellum 2 cellulae longiora; vacuola contractilis 2, apice; latere visa compressa, ovata; lateribus parallelis, apicis cum spinis brevissimis obliquis et recurvis, ventre ovatis et spinis; lg. 15 mi., lt. 11 mi. Hab. 2.

**101. PTEROMONAS ROTUNDATA sp. nov.** **Plate 2, fig. 33.**

Cellula fronte rotundata, papillo nullo; membrana crassa, hyalina; vacuola contractilis 2; stigma indistincta; nucleus in medio cellulae; chloroplastae parietalis; pyrenoide 3; flagellum 2 cellulae longiora; vertice et latere rotundata, apicibus papillata; diam. cellulae 12 mi. Hab. 2.

**102. PTEROMONAS ARMATA sp. nov.** **Plate 2, fig. 34.**

Cellula fronte visa cylindrica, parte anteriore concava, non papillata; angulis rotundatis, parte posteriore recta, 3 spinosa; cellulae membrana hyalina, rigida; cytoplasma oblonga retractum ad cellulae parte anteriore affixem; chloroplastae parietalis, granulata; pyreniode 1 mediana; nucleus non vidi; stigma parte anteriore; flagellum 2 cellulae longiora; latere et vertice visa oblonga vel ovata, apicibus cum spinis brevissimus obliquis recurvis; lg. 14–15 mi., lt. 8 mi. Hab. 2.

**103. PTEROMONAS UNDULATA sp. nov.** **Plate 2, fig. 35.**

Cellula fronte visa fere rectangularis, tota marginae irregulariter undulata; membrana hyalina, firma; cytoplasma elongata, apice attenuata, retractum ad cellulae parte anteriore affixem; papillo nullo; chloroplastae parietalis; pyrenoide nullo; nucleus in medio cellulae; stigma juxta apicem; vacuola contractilis 2; flagellum 2 cellulae longiora; latere et vertice visa elongata vel sphaericis, apicibus spinis recurvis; lg. 14 mi., lt. 11 mi. Hab. 2.

**104. PTEROMONAS ROTANTES sp. nov.** **Plate 2, fig. 36.**

Cellula fronte subhexagona, parte anteriore apice plano, angulis superioribus oblique-truncatis; lateribus modice concavis; parte posteriore recta, concava; membrana firma et hyalina; cytoplasma oblonga, retractum ad cellulae parte anteriore affixem; papillo nullo; chloroplastate parietalis; pyrenoide 1, centralis; nucleus in medio cellulae; stigma juxta apicem; flagellum 2 cellulae longiora; vacuola contractilis 2, cellula latere visa 7-gona cum lateribus concavis, vertice visa rotundata, apicibus spinis recurvis; lg. 15 mi., lt. 9–10 mi. Hab. 2.

**105. PTEROMONAS PLANCTONICA sp. nov.** **Plate 2, fig. 37.**

Cellula fronte visa subhexagona, parte anteriore cornuta, cornis acutis; lateribus concavae, angulis acutis, parte posteriore conica; membrana hyalina, rigida; cytoplasma oblonga retractum ad cellulae parte anteriore affixem; papillo nullo; flagellum 2 cellulae longiora; vacuola contractilis 2; chloro-

plastae parietalis; pyrenoide 4; nucleus centralis; latere et vertice visa oblonga vel ovata, lateribus incisus, apicibus spinis recurvis preditis; lg. 22 mi., lt. 14 mi. Hab. 2.

**106. PTEROMONAS CAUDATA sp. nov.** **Plate 2, fig. 38.**

Cellula fronte visa elongato-ovalis, apicibus acutis, lateribus parallelis parte anteriore papillata; membrana hyalina, rigida; cytoplasma oblonga retractum ad cellulae parte anteriore affixem; chloroplastae parietalis, granulata; pyrenoide 1, parte posteriore; stigma parte anteriore; nucleus in medio cellulae; flagellum 2 cellulae longiora; nucleus in medio cellulae; flagellum 2 cellulae longiora; vacuola contractilis 2; latere et vertice visa oblonga vel ovata, apicibus cum spinis recurvis; lg. 15 mi., lt. 13 mi. Hab. 2.

**107. PTEROMONAS SPINOSA sp. nov.** **Plate 2, fig. 39.**

Cellula fronte visa rectangularis, parte anteriore et posteriore spinosa; membrana hyalina, firma, lateribus modice convexis; cytoplasma ovata, apice attenuata retractum ad cellulae parte anteriore affixem; papillo nullo; chloroplastae parietalis; pyrenoide 3; stigma juxta apicem; vacuola contractilis 2; flagellum 2 cellulae longiora; latere et vertice visa oblonga vel ovata, lateribus arcuatis, apicibus cum spinis recurvis; lg. 22–28 mi., lg. 11–18. Hab. 2. *Pteromonas aculeata* Lemm. affinis, differs latere et vertice visa.

**108. PTEROMONAS SIMPLEX sp. nov.** **Plate 2, fig. 40.**

Cellula fronte fere orbicularis vel suborbicularis, latere late ovalis, angulis spinis praeditae, apicibus attenuata, latere incisa vel constricta, vertice ovata cum projectionis apicalis, latere modice incisa; chloroplastae parietalis; pyrenoide 1 centralis; stigma nullo; flagellum 2 cellulae longiora; vacuola contractilis 2 apice; lg. 15–18 mi., lt. 11–12 mi. Hab. 2.

**109. PTEROMONAS LONGICOLLIS sp. nov.** **Plate 2, fig. 41.**

Cellulae membrana fronte visa fere quadrata, apice cuneata, obliquae, a tergo lato-acuminata, latere plana, lanceolata-ellipticae, apicibus et lateribus acutis, armatis; chloroplastae parietalis; pyrenoide 1 fere centralis; flagellum 2 cellulae 1.2 longiora; vacuola contractilis 2 apice; stigma nullo; lg. et lt. 15 mi. Hab. 2.

**110. PTEROMONAS OBTUSA nom. nov.** **Plate 2, fig. 42.**

*P. angulosa* Lemm. var. *obtusa* SKVORTZOW in Arch. Protist. 66 (1929) 163, fig. 11.

Cellula fronte visa rotundata-quadrata, parte anteriore concavae, parte posteriore rotundata; membrana hyalina; cytoplasma sphaerica modice retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide centralis, nucleus in medio cellulae; stigma nullo; flagellum 2 cellulae longiora; lg. et lt. 13 mi. Hab. Manshuria borealis, prope Ertientziantze in aquis stagnalis.

**111. PTERMONAS INCURVA nom. nov.** **Plate 2, fig. 43.**

*P. angulosa* Lemm. var. *incurva* SKVORTZOW in Arch. Protist. 66 (1929) 163, fig. 12.

Cellula fronte visa quadrata, angulis unaequalis, rotundatis, lateribus concavis; membrana hyalina; cytoplasma cordata, retractum ad cellulae parte anteriore affixem; stigma nullo; vacuola contractilis non vidi; chloroplastae parietalis; pyrenoide 1 parte posteriore; flagellum cellulae longiora; latere et vertice visa ovalis, lateribus incisa, apicibus cum spinis recurvatis; lg. et lt. 13–14 mi. Hab. Manshuria borealis, prope Ertientziantze in aquis stagnalis.

**112. PTEROMONAS INCISA sp. nov.** **Plate 2, fig. 44.**

Cellula fronte visa ovalia, parte anteriore concavae, angulis acutis, parte posteriore rotundatis, lateribus arcuatis; cytoplasma elongata 6-gona retractum ad cellulae parte anteriore affixem; lateribus cytoplasma concava, apice acuta; chloroplastae parietalis; pyrenoide 1 centralis; nucleus in medio cellulae; vacuola contractilis indistinctis; stigma juxta apicem; flagellum 2 cellulae longiora; latere et vertice visa ovalis, lateribus incisa, apicibus cum spinis recurvatis; lg. 25 mi., lt. 16 mi. Hab. 2.

**113. PTEROMONAS SUBCORDIFORMIS sp. nov.** **Plate 2, fig. 45.**

Cellula superne rectangularis, lateribus rectis, inferne acuminato-rotundata; cytoplasma oblonga, apicibus attenuatis retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide 1 lateralis; nucleus in medio cellulae; vacuola contractilis 2; stigma juxta apicem; flagellum 2 cellulae longiora; latere et vertice visa oblonga vel ovata, lateribus arcuatis, apicibus cum spinis rectis; lg. 15 mi., lt. 13 mi. Hab. 2.

**114. PTEROMONAS ACUTA sp. nov.** **Plate 3, fig. 1.**

Cellula fronte visa ovalis, parte anteriore rotundata, parte posteriore elongato-acuta; cytoplasma ovalia retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide 5; nucleus in medio cellulae; vacuola contractilis 2; stigma nullo; flagellum 2 cellulae longiora; latere et vertice visa ovalis cum

lateribus arcuatis, apicibus cum spinis rectis; lg. 22 mi., lt. 18 mi. Hab. 2.

**115. PTEROMONAS KORSCHIKOFFI Skvortzow.** **Plate 3, fig. 3.**

*P. Korschikoffi* SKVORTZOW in Arch. Protist. 66 (1929) 166, fig. 10.

Cellula fronte visa ovalis, parte anteriore abrupta, medio concava, angulis lateralibus rotundatis, parte posteriore modice attenuatis et rotundatis; cytoplasma ovalia, apice late, pone acutae, retractum ad cellulae parte anteriore affixem, lateribus cytoplasmae arcuatis; chloroplastae parietalis pyrenoide 3; nucleus in medio cellulae; vacuola contractilis 2; stigma juxta apicem; flagellum 2 cellulae longiora; latere et vertice visa ovalis, lateribus incisa, apicibus cum spinis recurvis; lg. 20 mi., lt. 15 mi. Hab. Manshuria borealis, prope Ertientziantze in aquis stagnalis.

**116. PTEROMONAS ANGULOSA Lemm. var. ELONGATA Skvortzow.** **Plate 3, fig. 3.**

*P. angulosa* Lemm. var. *elongata* SKVORTZOW in Arch. Protist. 66 (1929) 163, fig. 10.

Cellula fronte visa cylindrica, parte anteriore abrupta, truncata, angulis surectangularis, parte posteriore truncato-rotundata; membrana hyalina; cytoplasma ovalia retractum ad cellulae parte anteriore affixem; chloroplastae parietalis; pyreniode centralis; nucleus in medio cellulae; vacuola contractilis 2 apice; flagellum cellulae longiora; latere lanceolata, lateribus arcuatis, parte anteriore truncata, posteriore acuta; lg. 12 mi., lt. 7 mi. Hab. Manshuria borealis, prope Ertientziantze in aquis stagnalibus. Differt a typo cellulae elongatis.

**117. PTEROMONAS CORNUTA Skvortzow.** **Plate 3, fig. 4.**

*P. cornuta* SKVORTZOW in Arch. Protist. 66 (1929) 163, figs. 14, 15.

Cellula fronte visa fere rotundata, apicibus depressis, lateribus rotundatis; membrana hyalina; cytoplasma ovalis retractum, parte anteriore acutis ad cellulae affixem, parte posteriore abrupta et cornuta; chloroplastae parietalis; pyrenoide 1 parte anteriore; nucleus in medio cellulae; stigma lateralis; vacuola contractilis 2 apice; flagellum cellulae longiora; sectione fere quadrata, lateribus incisa, apicibus apinis recurvis. Hab. Manshuria borealis, prope Ertientziantze in aquis stagnalis.

**118. PTEROMONAS RUGOSA sp. nov.** **Plate 3, fig. 5.**

Cellula fronte visa late-ovalis, parte anteriore concava, lateribus rotundatis, parte posteriore rotundatis, arcuatis; membrana hyalina, rugosa; cytoplasma elongata, attenuata retractum,

ad cellulae parte anteriore affixem; chloroplastae parietalis; pyrenoide 1 lateralis; nucleus in medio cellulae; stigma juxta apicem; vacuola contractilis 2; flagellum 2 cellulae longiora; latere et vertice visa oblonga vel ovalis, lateribus incisa, apicibus spinis recurvis; lg. 26 mi., lt. 18 mi. Hab. 2.

**119. PTEROMONAS CONSPERSA** Skvortzow. **Plate 3, fig. 6.**

*P. conspersa* Skvortzow in Arch. Hydrob. 18 (1927) 133, fig. 2.

Cellula elongata, apicibus attenuatis et rotundatis; parte anteriore rotundata, parte posteriore modice acuta, lateribus arcuatis; membrana hyalina, modice rugosa; cytoplasma elongata retractum, ad fronte parte anteriore affixem; Chloroplastae parietalis; pyrenoide 1 centralis; nucleus in medio cellulae; stigma juxta apicem; vacuola contractilis 2 apice flagellum 2 cellulae longiora; latere visa lanceolata, vertice ovata cum spinis rectis; lg. 18–22 mi., lt., 11–19 mi. Hab. 2.

## POLYTOMEÆ

**120. TETREBLEPHARIS ORBICULATA sp. nov.** **Plate 3, fig. 7.**

Cellula orbicularis; membrana tenuissima, hyalina; stigma nullo; nucleus centralis; pyrenoide propter nucleus; granula amylacea numerosa; flagellum 4 cellulae sesqui (1.5) longius; vacuola contractilis pone; Hab. 1.

**121. POLYTOMA ACUTA sp. nov.** **Plate 3, fig. 8.**

Cellula elliptica, parte superiore acuta, parte posteriore rotundata; membrana firma; cytoplasma non retractum; papillo et stigma nullo; flagellum cellulae longiora; nucleus in medio cellulae; vacuola contractilis superiore 2; granulae amylacea rotundata parte posteriore; lg. 18 mi., lt. 7.4 mi. Hab. 2. Affinis *Polytoma minus* Pasch.

**122. POLYTOMA LONGICILIATA sp. nov.** **Plate 3, fig. 9.**

Cellula late-ovata, polis rotundatis; membrana distincta; papillo minor; nucleus in medio cellulae, vacuola contractilis parte superiore 2; granulae amylacea minor, parte superiore; stigma nullo; flagellum duplo cellulae longiora; lg. 11–12 mi., lt. 5–7 mi. Hab. 2. Affinis *Polytoma uvella* Ehrenb., differt flagellum longioris.

**123. POLYTOMA SUBCYLINDRICA sp. nov.** **Plate 3, fig. 10.**

Cellula subcylindrica, parte superiore papillata; papillo lata; parte posteriore abrupta; membrana brunnea, rigida in medio cellulae; stigma lateralis; vacuola contractilis 2 fronte; flagellum cellulae longiora; granulae amylacea rotundata; lg. 14 mi., lt. 7 mi. Hab. 2. Affinis *Polytoma papillatum* Pasch.

**124. POLYTOMA COMMUNIS sp. nov.** **Plate 3, fig. 11.**

Cellula sphaerica; papillo nullo; membrana crassa; vacuola contractilis 2 parte superiore; stigma lateralis; vacuola secundariae 2–3 sphaericis; nucleus in medio cellulae; granulae amylacea rotundata, numerosa; flagellum cellulae longiora; lg. 7–11 mi. Hab. 2.

**125. POLYTOMA CUCUMIS sp. nov.** **Plate 3, fig. 12.**

Cellula cylindrica apicibus rotundatis; membrana rigida, longitudinaliter striata; papillo nullo; flagellum cellulae longiora; vacuola contractilis 2 fronte; nucleus in medio cellulae; granulae amylacea magna parte anteriore et posteriore; lg. 37 mi., lt. 7–8 mi. Hab. 2.

**126. POLYTOMA CURVATA sp. nov.** **Plate 3, fig. 13.**

Cellula obovata, fronte globosa, pone curvata et acuta; membrana firma; vacuola contractilis 2 fronte; nucleus in medio cellylae; granulae amylacea fronte; stigma nullo; flagellum cellulae longiora; lg. 12 mi., lt. 6 mi. Hab. 2.

**127. HYALOGONIUM HYEMALE sp. nov.** **Plate 3, fig. 14.**

Cellula fusiformis, gracillima, pone acutissima fronte rostrata; membrana tenuissima non metabolica; nucleus in medio cellulae; flagellum 2 ad ⅔ longitudinis cellulae longiora; vacuola contractilis singula fronte; lg. 30 mi., lt. 3.5 mi. Hab. 1.

## VOLVOCINÆ

**128. CHLAMYDOBOTRIS ASIATICA sp. nov.** **Plate 6, fig. 47.**

Coenobia libre natantia; dispositio cellularum tetradesma; cellulae elliptica, lg. 11 mi. lt., 7 mi. apicibus late rotundatis; chromatophora granulata; stigma nullo; flagellum 2 cellulae 1–1.5 longiora. Differt a *Chlamydobotris gracilis* Korsch. et *Chlamydobotris Korschikoffii* Pascher cellulae ellipticis et ceonobis tetradesmicis. Hab. 1.

**129. VALVULINA PLAYFERIANA sp. nov.** **Plate 6, fig. 48.**

Coenobia sphaerica, 20–25 mi. in diam., gelatinosa; cellula semiorbicularis, reniformis; fronte truncata, a tergo late-rotundata, 6–7 mi.; chromatophora granulata; stigma non vidi; flagellum duplo cellulae longiora. Hab. 1.

## EUGLENACEÆ

**130. EUGLENA INTERVOLANS sp. nov.** **Plate 3, fig. 17.**

Membrana hyalina, metabolica non striata; cellula elongata, oblongo-ovalis, parte anteriore acuta, parte posteriore rotundata; chloroplastae parietalis; pyreniode centralis; nucleus in medio

cellulae; stigma et vacuola contractilis apice; flagellum cellulae longiora; lg. 22–24 mi., lt. 8 mi. Hab. 1.

**131. EUGLENA MESSULA sp. nov.** **Plate 3, fig. 18.**

Membrana hyalina, modice metabolica; cellula ovalia, apicibus attenuatis et rotundatis; chloroplastae 2 viridia, lateralia et magna; nucleus in medio cellulae; granula paramylacea 5 discoidea non annulata; vacuola contractilis fronte; stigma nullo; flagellum apice cellulae longiora; lg. 12–15 mi., lt. 9–11 mi. Hab. 2.

**132. EUGLENA ORTHIA sp. nov.** **Plate 3, fig. 19.**

Membrana hyalina striata; cellula fusiformis pone rotundatis; apice acuminatis; chloroplastae 5 magna discoidea; nucleus in medio cellulae; granulae paramylacea minor bacillariformis; stigma et vacuola contractilis apice; flagellum ¾ cellulae longiora; lg. 74 mi., lt. 8.5 mi. Hab. 2.

**133. EUGLENA SUBACUTISSIMA sp. nov.** **Plate 3, fig. 23.**

Cellula fusiformis; membrana hyalina, spiraliter striata, parte anteriore obtuso-rotundata, lateribus non arcuatis, parte posteriore spinosa; spina ⅓ cellulae longiora; chloroplastae viridia, discoidea, minor, numerosa; nucleus in medio cellulae; stigma et vacuola contractilis apice; granula ramylacea 2 bacillariformes; flagellum cellulae longiora; lg. 74 mi., lt. 4 mi. Hab. 2. Affinis acutissima Lemm. differt cellulae attenuatis.

**134. EUGLENA VIRIDIS Ehrenb, var. HYALINA var. nov.** **Plate 3, fig. 26.**

Membrana hyalina non striata; cellula 30 mi. lg., 9 mi. it. Differt a typo membranae hyalinae.

**135. PHACUS ANACEOLUS Stokes var. ASIATICA var. nov.** **Plate 3, fig. 27.**

Cellula ovalis, apice attenuata et rotundata, pone late rotundata cum cauda rostrata, latere incisa; granulae paramylacea 1 discoidea, annulata; stigma apice; nucleus in medio cellulae; lg. 37 mi., lt. 22 mi. Hab. 2.

**136–142. PHACUS SPINIFER sp. nov.** **Plate 3, fig. 29.**

Cellula lare ovalis, apicibus modice attenuatis, pone longe caudata; membrana striata; chloroplastae viridia, discoidea, numerosa; discis parvis; nucleus in medio cellulae; granulae paramylacea 3, discoidea et annulata; flagellum cellulae longiora; lg. 77 mi., lt. 51 mi. Hab. 1.

**143. PHACUS PEDIFORMIS sp. nov.** **Plate 3, fig. 30.**

Cellula semi-ovalia, parte dorsalis arcuata, parte ventralis fere recta; cauda cellulae longiora, curvata; membrana striata; chlorophora viridia, discoidea, numerosa, parva; nucleus in medio

cellulae; granulae paramylacea discoidea, annulata; stigma apice; lg. 92–98 (cum cauda), cauda 40–45 mi. Hab. 1.

**144. PHACUS ROTUNDATA sp. nov.** **Plate 3, fig. 31.**

Membrana hyalina, spiraliter striata; cellula late ovalis vel fere rotundata, sectione depressa, parte anteriore bi divisa, parte posteriore modice evoluta non caudata; crista dorsalis ad mediam cellulae; granulae paramylacea in centrum cellulae, annuliformis; chloroplastae viridia, discoidea, parva, numerosa; lg. 40 mi., lt. 30 mi. Hab. 2.

**145. PHACUS HYALINA sp. nov.** **Plate 3, fig. 32.**

Membrana firma, hyalina non striata; cellula elongata, apicibus attenuatis; fronte rotundata, apice spinosa; vacuola contractilis et flagellum cellulae longius, fronte; stigma lateralis; nucleus fere in medio cellulae; vacuola secundariae sphaerica; granulae paramylacea minor, elongata, numerosa; chloroplastae discoidea, distincta; lg. 29 mi., lt. 15 mi. Hab. 2. Affinis *Phacus caudata* Hubner.

**146. PHACUS OVALIS sp. nov.** **Table 3, fig. 33.**

Cellula ovata vel elongato-ovata, apicibus rotundatis fronte concavae, apice spinis hyalinis rectis praedita; membrana longitudinalis striata; stigma fronte; nucleus centralis; chloroplastae viridia, numerosa, discoidea; granulae paramylacea 2 sphaerica, magna, annulata; lg. 28 mi., lt. 12 mi. Hab. 2. Affinis *Phacus caudata* Hubner.

**147. PHACUS CIRCULATA sp. nov.** **Plate 3, fig. 34.**

Cellula fronte visa circulata sed modice quadrata, apicibus rotundata, a tergo apinis hyalinis, rectis praedita; membrana spiraliter striata; stigma lateralis; nucleus centralis; chloroplastae viridia, numerosa, discoidea; granulae paramylaceae bacilliformis, numerosis; flagellum cellulae longiora; lg. 33–37 mi., lt. 18 mi. Hab. 2.

**148. PHACUS ÆNIGMATICA Drezepolski var. ASIATICA var. nov.** **Plate 3, fig. 35.**

Cellula 18 mi. lg., 9 mi, lit.; granulae paramylacea ovalis, minor, lateralis parte anteriore. Differt a typo granulae paramylacea minoris. Hab. 2.

**149. PHACUS SPIRALIS sp. nov.** **Plate 3, fig. 36.**

Membrana hyalina, spiraliter striata; cellula ovalis, parte anteriore lateribus spiraliter curvatis, apice rotundatis; parte posteriore acuta; nucleus in medio cellulae; chloroplastae viridia, numerosa, discoidea; granulae paramylacae 1 ovata, apice; stigma non vodi; flagellum cellulae longius; lg. 18 mi., lt. 11 mi. Hab. 2.

**150. PHACUS CANÆ sp. nov.** **Plate 3, fig. 37.**

Membrana hyalina et striata; cellula obliquae-triquetra, sectione depressa, parte anteriore incisa et concava, posteriore elongata, attenuata et acuta; stigma supra medium posita; chloroplastae viridia, numerosa, discoidea; granulae paramylacea oblonga vel fere quadrangulare, parte anteriore et posteriore positae; flagellum cellulae longius; lg. 18–25 mi., lt. 11 mi. Hab. 2.

**151. PHACUS CARINATA sp. nov.** **Plate 3, fig. 38.**

Membrana hyalina, spiraliter striata; cellula fere orbicularis, parte anteriore rotundatis, posteriore caudis parvis et rostratis praedita; lateris incrassatis, in sectione fere triquetra; stigma supra medium posito; granulae paramylacea 2 annuliformis, lateralis; nucleus in medio cellulae; flagellum parte anteriore; lg. 29–37 mi., lt. 22–23 mi. Hab. 2.

**152. PHACUS TRIQUETER (Ehrenb.) Duj. var. LATA var. nov.** **Plate 3, fig. 39.**

Cellula latiora; lg. 33 mi., lt. 25 mi. Hab. 2.

**153. PHACUS RAPACEA sp. nov.** **Plate 3, fig. 40.**

Cellula late-orbiculata cum polis arcuatis; membrana striata, parte posteriore caudis parvis et rostratis praedita; nucleus in medio cellulae late-ovalia; granulae paramylacea 1 rotundata non annulata, magna; stigma apice; sectione adpressum et triquetrum; lg. 30 mi., lt. 40 mi. Hab. 2.

**154. LEPOCINCLIS SUNGARIENSIS sp. nov.** **Plate 3, fig. 41.**

Membrana non metabolica, hyalina, distincte striata; cellula obovata, fronte late rotundata, apice acuta, hyalina, vertice rotundata, margine undulata, non depressa; flagellum cellulae longiora; chloroplastae discoidea, numerosa; granulae paramylaceae minuta; stigma latere posita; movet porro, rotante; lg. 15 mi., lt. 8 mi. Hab. 2.

**155. LEPOCINCLIS OVALIS sp. nov.** **Plate 3, fig. 42.**

Cellula ovalis, fronte fissura obliqua instructa; basi brevi caudata; chloroplastae stellatum; flagellum 1, in fissura frontalis insertum, curvatum; cellula sesqui (1.5) vel ad ⅔ longius; membrana firma, flavescens, tortuosa-striata; granulae paramylonae numerosa, sphaerica non annulata; stigma fronte; lg. 18–19 mi., lt. 11–12 mi. Hab. 2.

**156. LEPOCINCLIS CORDIFORMIS sp. nov.** **Plate 3, fig. 43.**

Cellula corata vel rotundata, parte anteriore in medio concavae cum lateribus rotundatis; parte posteriore modice acuta; sectione modice depressa et ovata; membrana rigida, pallodo-brunnea,

spiraliter striata; chloroplastae viridia, parietalia, non discoidea; granula paramylacea rotundata non annulata; nucleus in medio cellulae; flagellum cellulae longiora; lg. 48 mi., lt. 40 mi. Hab. 2.

**157. LEPOCINCLIS MINOR sp. nov.** **Plate 3, fig. 44.**

Membrana hyalina non striata; cellula sphaerica, depressa, apicibus acutis, parte anteriore papillata, hyalina cum stigma et flagellum cellulae longiora; parte posteriore caudis parvis praedita; sectione rotundatis non depressis; chloroplastae viridia, numerosa, discoidea; granula paramylacea curvato-elongatis, numerosis; nucleus centralis; lg. et lt. 11 mi. Hab. 2.

**158. LEPONCINCLIS ACUTA sp. nov.** **Plate 3, fig. 45.**

Membrana non metabolica, hyalina, non striata; cellula late-ovali, apicibus attenuatis, pone acuta, sectione rotundata, non depressa; stigma et flagellum cellulae longiora fronte; nucleus centralis; chloroplastae viridia, numerosa, discoidea, granula paramylacea 3 magna, ovalis; lg. 30 mi., lt. 25 mi. Hab. 2. Differt a *Lepocinclis ovalis* chloroplastae discoideis, membrana non striatis et apice acutis.

**159. CRYPTOGLENA TUMIDA sp. nov.** **Plate 3, fig. 46.**

Cellula late-ovalis vel ovalis, apicibus late rotundatis, latere depressis, vertice reniformis; membrana rigida, non metabolica; chloroplastae 2 lateralis, viridis; stigma fronte; vacuola contractilis 2 fronte; granulae paramylacae numerosa in medio cellulae; flagellum 1 fronte cellulae longiora; lg. 15–18 mi., lt. 9–11 mi. Hab. 2. Differt a *Cryptoglena pigra* Ehrenb. cellulae late ovalis.

**160. CRYPTOGLENA CORNUTA sp. nov.** **Plate 3, fig. 47.**

Cellula fronte obovata, parte anteriore attenuata, incisa, modice cornuta, lateribus arcutis, parte posteriore cumeata et acuta, apice rotundata; cellulae lateribus depressa, elongato-lanceolata, parte anteriore alata, parte posteriore attenuata; membrana hyalina, striata; chloroplastae 2 lateralis; nucleus in medio cellulae; granulae paramylacea rotundatis, numerosis; lg. 15 mi., lt. 9 mi., flagellum cellulae longiora; stigma nullum. Hab. 2.

**161. CRYPTOGLENA LONGICAUDA sp. nov.** **Plate 3, fig. 48.**

Membrana firma, hyalina, non metabolica; cellula ovalia, apice et pone attenuata modice rotundata; chloroplastae viridis, discoidea, magna, lateralis; nucleus in medio cellulae; stigma et vacuola contractilis fronte; flagellum plo 3 cellulae longiora; movet porro rotante; lg. 11 mi., lt. 7 mi. Hab. 2.

**162. COLACIUM TRACHELOMONOIDES sp. nov.** **Plate 3, fig. 49.**

Cellula late ovalis vel ovalis, apicibus rotundatis vel pone papillatis; membrana hyalina, metabolica; flagellum non vidi; vacuola contractilis fronte cum stigma distinctum; chloroplastae 2 lateralis; granulae paramylacea numerosa, minir; lg. 18 mi., lt. 7 mi., petiolum 2 mi., Hab. 2, epiphyticis apud testae *Trachelomonadis*.

**163. EUTREPTIA STAGNALIS sp. nov.** **Plate 3, fig. 50.**

Cellula elongata, apicibus attenuatis, acutis; membrana metabolica hyalina non striata; chloroplastae granulata, granulae numerosa; granulae paramylacea ovalis; stigma elongata apice; vacuola contractilis fronte; flagellum 2 fronte equilonga, apice cellulae instructa, ½ cellulae longiora; nucleus in medio cellulae; movet porro, rotanti; lg. 55 mi., lt. 25 mi. Hab. 2.

Differt a *Eutreptiae vulgaris* Perty membranae hyalinis.

## ASTASIACEÆ

*Clavis generis Astasiacæ*

A. Flagellum 1.
- a. Cellula metabolica.
  - b. Organum baculiforme (Staborgan) abest ..... *Astasiella* gen. nov.
  - bb. Organum baculiforme nullum.
    - *c.* Granula paramylacea non annulata ..... *Astasia* Duj.
    - cc. Granula Paramylacea Annulata ..... *Paramylomonas* gen. nov.
- aa. Cellula non metabolica.
  - b. Granula paramylacea non annulata ..... *Menoidium* Perty.
  - bb. Granula paramylacea annulata ..... *Menoidiomonas* gen. nov.

AA. Flagellum 2.
- a. Flagellum non aequilongum.
  - b. Cellula metabolica.
    - c. Granula paramylacea cylindrica, non annulata ..... *Distigma* Ehr.
    - cc. Granula paramylacea discoidea, annulata .... *Baranovia* gen. nov.
  - bb. Cellula non metabolica ..... *Sphenomonas* Stein.
- aa. Flagellum aequilongum.
  - b. Flagellum parte anteriore insertum.
    - c. Cellula latere depressa, membrana spiraliter striata; nutrimentum animali simile vel saprophyticum..... *Ampullamonas* gen. nov.
    - cc. Cellula non latere depressa; nutrimentum saprophyticum. *Schewiakowia* gen. nov.
  - bb. Flagellum latere in fissura frontalis insertum. *Mereschkowskiella* gen. nov.

### Genus ASTASIELLA novum

Membrana metabolica, rigida, hyalina non striata; cellula elongata vel elongato-ovata, fronte acuminata, tergo rotundata; organum baculiforme (Staborgan) et vacuola contractilis et flagellum cellulae longiora, fronte; nucleus centralis; granula

paramylacea rotundata, major, numerosa; vacuola secudariae una, sphaerica, pone; movet repente porro; nutrimentum saprophyticum, non animali simile; differt generis *Astasia* organum baculiforme, de generis *Peranema* granulae paramylacea.

**164. ASTASIELLA PERANEMIFORMIS sp. nov.** **Plate 3, fig. 51.**

Flagellum cellulae aequilonga; lg. 50–55 mi., lt. 15–20 mi. Hab. 2.

**165. ASTASIA LONGICAUDA sp. nov.** **Plate 3, fig. 52.**

Membrana hyalina, modice metabolica, non striata; cellula elongato-ovalis, parte anteriore acuta et rotundata, parte posteriore longe acuminata, hyalina; nucleus in medio cellulae; stigma et vacuola contractilis apice; granulae paramylacea numerosa, ovalia; flagellum cellulae longius; lg. 59–62 mi., lt. 18–20 mi., cauda lg. 11 mi. Hab. 2.

**166. ASTASIA DISSECTA sp. nov.** **Plate 3, fig. 53.**

Membrana robusta, hyalina; metabolica, non striata; cellula elongata-triquetra, parte anteriore acuta, parte posteriore lata, dissecta vel furcata; nucleus in medio cellulae; vacuola contractilis apice; granulae paramylacea numerosa, minor, ovalia; flagellum cellulae longiora; movet porro; lg. 37 mi., lt. 15 mi. Hab. 2.

**167. ASTASIA LONGIFLAGELLATA sp. nov.** **Plate 3, fig. 54.**

Membrana hyalina, modice metabolica; cellula late ovalis, parte anteriore acuminata, parte posteriore late rotundata; vacuola contractilis apice; vacuola secundariae numerosae; nutrimentum animali simile; flagellum crassa, apice, 2½–3 cellulae longiora; movet porro, repente; in sectione cellula non depressa; diam. 18 mi. Hab. 2.

**168. ASTASIA DISTINCTA sp. nov.** **Plate 3, fig. 55.**

Membrana metabolica, hyalina, striata; cellula elongato-ovata; fronte attenuata cum vacuola contractilis et flagellum cellulae longiora; nucleus in medio cellulae; granula paramylacea magna, ovalis, numerosa; movet porro, rotante; lg. 44–55 mi., lt. 15–20 mi. Hab. 2.

**169. ASTASIA STIGMATELLA sp. nov.** **Plate 3, fig. 56.**

Membrana metabolica, hyalina; cellula elongata, apice attenuata, tergo late-rotundata, latere non depressa; stigma et vacuola contractilis fronte; nucleus in medio cellulae; granula paramylacea sphaerica, magna, numerosa; flagellum 1 fronte cellulae longiora; lg. 25–48 mi., lt. 15 mi. Hab. 2. *Astasia lagenula* (Schew.) Lemm. affinis, differt stigmae.

**170. ASTASIA STRIATA sp. nov.** **Plate 3, fig. 57.**

Membrana non metabolica, hyalina et distincte striata, fronte attenuata et acuta, apice late rotundata; vacuola contractilis non vidi; nucleus in latere cellulae; granulae paramylacea numerosa, minor; flagellum fronte, cellulae longiora; movet porro repente; lg. 18 mi., lt. 8 mi. Hab. 2.

**171. ASTASIA COMMUNIS sp. nov.** **Plate 3, fig. 16.**

Membrana metabolica, hyalina non striata; cellula fusiformis, apice late rotundata, pone attenuata, acuta vel obtusa; flagellum fronte ½ cellulae longiora; granula paramylacea ovalis, numerosa in parte superiore positis, apice nullum; nucleus in medio cellulae; movet porro et rotante; lg. 7–20.

**172. ASTASIA DETRITA sp. nov.** **Plate 3, fig. 15.**

Membrana metabolica, hyalina non striata; cellula ovalis, apice acuminata, pone late rotundata, in sectione depressa; vacuola contractilis fronte; vacuola secundariae minor, numerosa nucleus in medio cellulae; flagellum fronte cellulae longiora; movet porro; lg. 19–22 mi., lt. 7–8 mi. Hab. 2. in detritus.

**173. ASTASIA SERPENTA sp. nov.** **Plate 4, fig. 1.**

Membrana modice metabolica, hyalina et non striata; cellula longe-fusiformis, recta vel S-formis; fronte abbrupta, apice acuminata; nucleus in medio cellulae; granulae paramylacea ovalia, numerosa; flagellum cellulae longiora; movet porro rotante; lg. 37–42 mi., lt. 7–8 mi. Hab. 2. in detritus.

**174. ASTASIA TENUISSIMA sp. nov.** **Plate 4, fig. 2.**

Membrana metabolica, hyalina, non striata; cellula lanceolato-cylindrica cum lateribus parallelis, fronte attenuata, pone rotundata; vacuola contractilis fronte, secundariae pone; nucleus in medio cellulae; flagellum fronte cellulae longiora or longior; granula paramylacea non visa; movet porro, repente; lg. 35 mi., lt. 7 mi. Hab. 2. in detritus.

**175. ASTASIA REPENTES sp. nov.** **Plate 4, fig. 3.**

Membrana metabolica, hyalina, non striata; cellula elongata, apice modice attenuata, pone rotundata; nucleus in medio cellulae; granulae paramylacea ovata, numerosa, amylaceaeformis; movet porro repente non rotanti; flagellum 1.5 cellulae longiora; lg. 37 mi., lt. 8–9 mi. Hab. 2.

**176. ASTASIA LAGENARIAE sp. nov.** **Plate 4, fig. 4.**

Membrana metabolica, hyalina, non striata; cellula fusiformis vel ovata vel biconstricta, fronte obtusa, apice acuta; vacuola contractilis longiora fronte; nucleus centralis, oblonga; granulae

paramylacea bacilliformis, numerosis; flagellum ⅔ cellulae longiora; movet porro; lg. 37–55 mi., lt. 8–12 mi. Hab. 2.

**177. ASTASIA AUTOMNALE sp. nov.** **Plate 4, fig. 5.**

Membrana metabolica, hyalina et non striata; cellula elongato-ovata, fronte longitudine attenuata, pone rotundata, sectione non depressa; vacuola contractilis distinctis, elongatis, fronte; nucleus centralis; granula paramylacea apice ovalis, major vel minor, numerosae; flagellum cellulae longiora vel 1½ cellulae longiora; movet porro; lg. 18–37 mi., lt. 11–12 mi. Hab. 2.

**178. ASTASIA NUTABILIS sp. nov.** **Plate 4, fig. 7.**

Cellula fronte visa lanceolata, metabolica, apicibus attenuatis, latere visa subfalcata vel sublunata, vertice depresso curvata; vacuola principalis in apice cellulae; vacuola secundariae numerosae; flagellum cellulae aequilongum vel ejus duplo longius; nucleus in medio cellulae; nutrimentum saprophyticum; movet porro; lg. 9–11 mi., lt. 5–6 mi. Hab. 1.

**179. ASTASIA SIMILIS sp. nov.** **Plate 4, fig. 8.**

Cellula metabolica, rhombica, fusiformis vel falcata; membrana non striata; nucleus medio cellulae; granulae paramylacea ellipticis, numerosae; vacuola contractilis apice; flagellum fronte duplo cellulae longius; stigma nullum; lg. 20–29 mi., lt. 8–15 mi. Hab. 1. Affinis *Astasia ocellata* Khaw.

**180. ASTASIA GRANULATA sp. nov.** **Plate 4, fig. 9.**

Cellula ovalis vel pyriformis; membrana metabolica, pone cuneata vel truncata, basi lato rotundata; vacuola contractilis fronte; granulae paramylacea orbicularis, numerosae, amylaceaeformis; flagellum 1 cellulae longius; motio porro et rotanti; cellula lg. 12–18 mi., lt. 5–8 mi. Hab. 2.

**181. ASTASIA HYALINA (Skvortzow) Skvortzow nom. nov.**

A. *inflata.* Duj. var. *hyalina* Skvortzow in Arch. Protist. 48 (1924) 181, fig. A, 1.

**182. ASTASIA FALCATA nom. nov.**

A. *curvata* Skvortzow (non Klebs) ibid., 182, fig. A, 5.

**Genus PARAMYLOMONAS novum**

Membrana metabolica, hyalina; cellula oblongo-ovalis, parte anteriore acuta, parte posteriore late rotundata, latere depressa et obliquae; vacuola contractilis et flagellum fronte, anteriore; nucleus fronte; granulae paramylacea oblongum, magnum, annuliformis. Differt generis *Astasia* paramylacea annulatis.

**183. PARAMYLOMONAS ASTASIEFORMIS gen. et sp. nov.** **Plate 4, fig. 6.**

Cellula 29 mi., lg., 18 mi. lt.; flagellum cellulae longiora; movet porro, rotante; nutrimentum saprophyticum. Hab. 2.

**184. MENOIDIUM CLAVATUM sp. nov.** **Plate 4, fig. 10.**

Membrana tenuissima, firma non metabolica; cellulae elongato-ovalis, parte anteriore attenuata, parte posteriore late rotundata; nucleus in medio cellulae; vacuola contractilis apice; granula paramylacea rotunda 1 pone; flagellum tenuissimum cellulae longius; cellula lg. 11–12 mi., lt. 3.7–5.7 mi. Hab. 1.

**185. MENOIDIUM PATULUM sp. nov.** **Plate 4, fig. 11.**

Membrana non metabolica, hyalina et non striata; cellula fusiformis, apicibus attenuatis, fronte abrupta, apice longe acuminata; flagellum 1 fronte, 0.5 cellulae longiora; nucleus in medio cellulae; vacuola contractilis indistincta; granulae paramylacea ovalia, numerosae; movet porro et rotante; cellula lg. 74 mi., lt. 7 mi. Hab. 2 in detritus. Affinis *Meniodium falcatum* Zach.

**186. MENOIDIUM SÆVUM sp. nov.** **Plate 4, fig. 12.**

Membrana non metabolica et non striata; cellula lunata or semilunata, apicibus acutis, obliquiis, latere compressa; granulae paramylacea elongata, fronte; nucleus in medio cellulae; flagellum 1 cellulae longius; movet porro, rotante cellula lg. 50–59 mi., lt. 12–14 mi. Hab. 2 in detritus.

**187. MENOIDIUM INCURVUM sp. nov.** **Plate 4, fig. 13.**

Membrana non metabolica, hyalina et non striata; cellula late obliquae, ovalis, pone collum praedita, obliquae, grandulæ paramylacea minor, ovalis, numerosae; flagellum cellulae 0.5 longius; movet porro; lg. 15 mi., lt. 8 mi. Hab. 2.

**188. MENOIDIUM SINGULUM sp. nov.** **Plate 4, fig. 14.**

Cellula elongata vel subelliptica, pone attenuata, rotundata, basi latior, late-rotundata; membrana metabolica; granulae paramylacea 4, rotundata et nigra; vacuola contractilis pone, ovata; flagellum 1 cellulae longius; movet repente porro; cellula lg. 25 mi., lt. 8 mi. Hab. 2.

**189. MENOIDIUM EUGLENÆ sp. nov.** **Plate 4, fig. 15.**

Membrana metabolica non striate; cellula fusiformis, fronte abrupta, apice acuminata, lateribus modice curvata; vacuola contractilis fronte, elongata; nucleus in medio cellulae; granulae paramylacea bacilliformis, numerosae; flagellum cellulae longius; cellula lg. 62 mi., lt. 15 mi. Hab. 2 in detritus.

**190. MENOIDIUM RAPACIS sp. nov.** **Plate 4, fig. 16.**

Membrana non metabolica, distincte striata; cellula fusiformis, non depressa, fronte rotundata, apice acuta; nucleus juxta medio cellulae; granulae paramylacea in partis superne cellulae; movet rapide porro et rotante; flagellum cellulae longius; cellula lg. 55 mi., lt. 14 mi. Hab. 2 in detritus.

**191. MENOIDIUM SPIRILLUM sp. nov.** **Plate 4, fig. 17.**

Membrana non metabolica, hyalina et non striata; cellula S-formis, curvatis; fronte rotundata, apice acuta; vacuola contractilis indistinctis; granulae paramylacea ovalis, major, cateniformis; flagellum fronte, ⅔ cellulae longius; movet porro, rotante; lg. 14 mi., lt. 4 mi. Hab. 2 in detritus.

**192. MENOIDIUM DEPRESSUM sp. nov.** **Plate 4, fig. 18.**

Membrana non metabolica, hyalina, non striata; cellula fronte elongata, latere compressa et obliqua, apicibus late-rotundatis; granulae paramylacea rotundata, major, numerosae; vacuola contractilis fronte; nucleus fere medio cellulae; movet porro; flagellum 1 fronte, cellulae longius; lg. 15 mi., lt. 7 mi. Hab. 2 in detritus.

**193. MENOIDIUM SIMILIS sp. nov.** **Plate 4, fig. 19.**

Cellula late ovalis, apice acuta, pone late rotundata, in sectione late triquetra cum polis rotundatis; membrana non metabolica, hyalina et non striata; vacuola contractilis pone; vacuola secundariae numerosae; nucleus in medio cellulae; granulae paramylacea 1 magna, sphaerica; flagellum cellulae longius; lg. 22 mi., lt. 18 mi. Hab. 2.

**194. MENOIDIUM UTRICULARIÆ sp. nov.** **Plate 4, fig. 20.**

Cellula elongata, oblique-curvata, non metabolica; membrana firma, tenuissima, hyalina et non striata, basi lato rotundata, apice cuneata cum flagellum tenuissimum cellulae (1.5) sesquilongiore; nucleus in medio cellulae; granulae paramylacea ovales vel subsphaerica, basalia; vacuola contractilis apice; vacuola secundariae numerosae; lg. 8–11 (18) mi., lt. 3.5–5 (7) mi. Hab. 1. Affinis *Menoidium incurvum* (Fres.) Klebs.

**195. MENOIDIUM PSEUDOPERRUCIDUM nom. nov.**

*M. pellucidum* Skvortzow non Perty, Skvortzow in Arch. Protist. 48 (1924) 183, figs. A, 6 non 7.

**196. MENOIDIUM CLOSTERIIFORMIS nom. nov.**

*M. pellucidum* Skvortzow non Perty, *ibid.*, figs. 7 non 6.

### Genus MENOIDIOMONAS novum

Membrana non metabolica, hyalina non striata; cellula sphaerica, fronte acuta, basi late-rotundata, in sectione rotun-

data; nucleus in medio cellulae; vacuola contractilis fronte; granulae paramylacea rotundatis, annulatis. Differt a generis *Menoidium* granulae paramylacies annulatis.

**197. MENOIDIOMONAS OCULLATA gen. et sp. nov.** **Plate 4, fig. 21.**

Flagellum 1 fronte, cellulae longius; movet porro; cellula lg. 15 mi. Hab. 2. in detritus.

**198. MENOIDOMONAS SCHEWIAKOFFII nom. nov.** **Plate 4, fig. 22.**

*Menoidium Schewiakoffii* SKVORTZOW in Arch. Protist. 48 (1924) 183, fig. A, 8.

Membrana punctato-striata; granulae paramylacea annulatis; cellula lg. 20–25 mi., lt. 7–9 mi. Hab. In stagnis prope Charbin.

**199. DISTIGMA PAPILLATA sp. nov.** **Plate 4, fig. 23.**

Membrana metabolica, longitudinaliter striata; cellula elongata, vel rapacea, parte anteriore papillata, posteriore rotundata vel acuta; flagellum 2, principale cellulae longius, basale triplo brevior; flagellum principale et vacuola contractilis fronte praedita; nucleus in medio cellulae indistinctis; granulae paramylacea bacillariformis, numerosae, minuta; movet porro repente; cellula lg. 40 mi., lt. 15 mi. Hab. 2.

**Genus BARANOVIA novum**

Cellula hyalina, natantes; membrana metabolica; flagellum 2, principale cellulae longius, secundare 1½ cellulae longius; chromatophora nullo; vacuola numerosa; granulae paramylacea 1 disciformis, annulata; affinis generis *Distigma* Ehrenb. granulae paramylacea annulatis. Dedico hanc generis A. I. Baranov, botanico, Charbin.

**200. BARANOVIA STAGNALIS sp. nov.** **Plate 5, fig. 11.**

Cellula subcylindrica, apice truncata, pone rotundata, 25 mi lg., vacuola numerosa; granulae paramylacea 1, disciformis, orbicularis, annulata; flagellum 2 fronte cellulae longiora, basalia, 1.5 cellulae longius; movet porro. Hab. 1.

**Genus AMPULLAMONAS novum**

Membrana metabolica, rigidulo striata; hyalina; cellula fronte visa ovata, latere depressa, apice acuta, a tergo late rotundata et concava; flagellum 2, aequilonga, ⅔ cellulae longius, natandi, recta, movet repente, trachendi latere; vacuola contractilis fronte; vacuola secundariae numerosae; nucleus in medio cellulae.

stigma nullum; nutrimentum saprophyticum vel animali simile. Affinis generis *Distigma* Ehrenb., differt flagellum aequilongum et cellulae depressis.

**201. AMPULLAMONAS REPENTES gen. et sp. nov.** **Plate 4, fig. 24.**

Cellula ovata vel elongata, vel reniformis et vel depressa; membrana rigidula, striata et metabolica; flagellum 2 aequilonga ⅔ cellulae longiora; vacuola contractilis fronte; vacuola secundariae numerosae; nucleus centralis; movet porro, repente; nutrimentum saprophyticum vel animali simile; cellula lg. 37 mi., lt. 25 mi. Hab. 2 in detritus.

**202. AMPULLAMONAS ROTANTE sp. nov.** **Plate 4, fig. 25.**

Membrana metabolica, hyalina, spiraliter striata; cellula oblonga, ovalis vel pyriformis, parte anteriore acuta et abrupta, parte posteriore rotundata; vacuola contractilis et flagellum 2 aequilonga, 0.5 cellulae longius, parte anteriore; nucleus fere centralis; granulae paramylacea elongata, numerosae in parte posteriore; movet pone rotanta; nutrimentum saprophyticum; cellula lg. 45 mi., lt. 12 mi. Hab. 2.

**Genus SCHEWIAKOWIA novum**

Membrana metabolica, aequilonga, hyalina non striata; cellula ovata, fronte acuta, tergo rotundata; flagellum 2, fronte, aequilonga, cellulae (1.5) sesqui longius; principale vel natandi et secundare vel trahendi; vacuola contractilis fronte; vacuola secundare numerosae, minor a tergo; nucleus in medio cellulae; granulae paramylacea 3 magna, ovata, fronte; movet porro, repente. Differt a generis *Distigma* Ehrenb. flagellum aequilongum et granulae paramylacea majorobus. Dedico hanc generis ad memoriam Prof. W. T. Schewiakow, Irkutsk, Siberia.

**203. SCHEWIAKOWIA NATANTES gen. et sp. nov.** **Plate 4, fig. 26.**

Cellula lg. 18–22 mi., lt. 10–12 mi. Hab. 2.

**Genus MERESCHKOWSKIELLA novum**

Membrana rigida non metabolica et non striata; cellula fronte visa elongato-ovata, parte anteriore attenuata et rotundata, parte posteriore late rotundata, latere visa elongata, parte anteriore obliqua nasuta, lateribus rotundatis, parte posteriore rotundata; vacuola contractilis parte anteriore; nucleus centralis granulae paramylonae 2 oblonga, magna; flagellum 2 latere posita cellulae longius; vacuola secundare numerosae; nutrimenentum saprophyticum; movet porro et rotante. Affinis generis *Schewiakowia*, differt cellulae nasutae et flagellum latere positis.

**204. MERESCHKOWSKIELLA NASUTA gen. et sp. nov.** **Plate 4, fig. 27.**

Cellula lg. 19.5–19 mi. , lt. 10–12 mi. Hab. 2.

## PERANEMACEÆ

*Clavis generis Peranemaceæ*

A. Flagellum 1.
a. Membrana metabolica.
b. Organum baculiforme (Staborgan) nullum.
c. Porus vel stomata parte anteriore abest ..... *Euglenopsis* Klebs.
cc. Porus vel stoma parte anteriore nullum ..... *Baikowia* gen. nov.
bb. Organium baculiforme (Staborgan) abest.
c. Porus vel plica stomata abset ..... *Peranema* Duj.
cc. Porus vel plica stomata infundibuliformis ..... *Urceolus* Mereschk.
aa. Membrana firma, depressa ..... *Petalomonas* Stein.

AA. Flagellum 2.
a. Cellula non depressa.
b. Membrana metabolica ..... *Heteronema* Stein.
bb. Membrana non metabolica, firma ..... *Aliniella* gen. nov.
aa. Cellula depressa.
b. Plica longitudinalis ventralis abest ..... *Anisonema* Duj.
bb. Plica longitudinalis ventralis nullum ..... *Entosiphon* Stein.

### Genus BAIKOWIA novum

Membrana metabolica, hyalina, non striata; cellula elongato ovalis, fronte attenuata et acuta, non abrupta et non incisa; apice late rotundata, non acuminata; flagellum 1 fronte, recta, cellulae longius vel longiora; nucleus in mèdio cellulae; vacuola contractilis fronte indistincta; vacuola secundariae vel vacuola nutrimentum 3–5 sphaericis; nutrimentum animali simile (Chlamydomonaceæ). Dedico hanc generis N. A. Baikow, zoologo, Charbin.

**205. BAIKOWIA FEROX gen. et sp. nov. nom. nov.** **Plate 4, fig. 28.**

*Euglenopsis ovatus* Skvortzow in Species novae . . . (1926) 10, Plate 2, figs. 13, 14.

Cellula levissime metabolica; flagellum 1–1.5 cellulae longius; cellula lg. 25 mi., lt. 10–12 mi. Hab. 2. Affinis a generis *Euglenopsis* Klebs, fissura frontale nullum.

**206. PERANEMA HYALINA sp. nov.** **Plate 4, fig. 29.**

Membrana metabolica, hyalina et non striata; cellula elongata, fronte acuta, apice rotundata; organum baculiforme abest tergo; cellula lg. 32–55 mi., lt. 12 mi; vacuola contractilis et flagellum cellulae longius fronte; nucleus in medio cellulae; vacuola secundare tergo. Hab. 2.

**207. PERANEMA PLANCTONICA sp. nov.** **Plate 4, fig. 30.**

Membrana metabolica, hyalina, non striata; cellula elongata apicibus attenuatis, organum baculiforme (Staborgan) curta bacillariformis; vacuola contractilis et flagellum 1.5 cellulae longius fronte; vacuola secundare numerosae; nucleus in medio cellulae; nutrimentum animali simile (Diatomaceæ); cellula lg. 37 mi., lt. 12 mi. Hab. 2.

**208. PERANEMA OCELLATA sp. nov.** **Plate 4, fig. 31.**

Membrana metabolica, fima et distincte striata; cellula ovalis vel elongata, apicibus attenuatis; organum baculiforme (Staborgan), stigma, vacuola contractilis et flagellum, cellulae longius, fronte; nucleus centralis; vacuola secundare numerosae, sphaericis; nutrimentum animali simile; movet porro et repente; cellula lg. 26–32 mi., lt. 10–12 mi. Hab. 2.

**209. PERANEMA ACUTA sp. nov.** **Plate 4, fig. 32.**

Membrana metabolica, hyalina et non striata; cellula elongata, fronte attenuata, apice obliquae-acuta, vacuola contractilis, flagellum et organum baculiforme (Staborgan) fronte; nucleus centralis; flagellum cellulae longius; cellula lg. 37 mi. Hab. 2.

**210. PERANEMA FURCATA Skvortzow.** **Plate 4, fig. 33.**

*P. furcata* Skvortzow in Arch. Hydrob. 20 (1929) 322, fig. 1.

Cellula elongata, metabolica, striata, parte anteriore acuta, parte posteriore furcata; vacuola contractilis fronte; flagellum cellulae longius; nucleus in medio cellulae; vacuola secundare apice; cellula lg. 37–40 mi. Hab. In stagnis prope Charbin.

**211. PETALOMONAS PISCATOR sp. nov.** **Plate 4, fig. 34.**

Cellulae elongata, apicibus attenuatis; membrana hyalina, firma non metabolica; plica longitudinaliter tota cellula praedita; vacuola contractilis fronte; vacuola secundare minoris, numerosae; granulae paramylacea magna, ovata, in medio cellula inserta; cellula lg. 18 mi., lt. 10 mi. Hab. 2.

**212. PETALOMONAS DEPRESSA sp. nov.** **Plate 5, fig. 10.**

Cellula ovalis, fronte cuneata, apice lato rotundata; membrana non metabolica, latere compressa, reniformis; flagellum 1 fronte cellulae insertum, 1.5 cellulae longius; vacuola contractilis fronte; vacuola secundare numerosae; nutrimentum animali simile; nucleus in medio cellulae; cellula lg. 18 mi., lt. 9–12 mi. Hab. 2. Differt a *Petalomonas glabra* sp. nov. cellulae ovalis.

**213. PETALOMONAS ABRUPTA sp. nov.** **Plate 4, fig. 35.**

Membrana non metabolica, hyalina, rigidula et non striata; cellula late ovalis, fronte acuta, apice rotundata partim incisa

vel abrupta; vacuola contractilis 2–3 fronte et apice; nucleus in medio cellulae; cellula in sectione depressa; flagellum 1 fronte recta cellulae longius; movet repente porro; cellula lg. 25 mi., lt. 11 mi. Hab. 2. in detritus.

214. **PETALOMONAS RECTANGULARIS** sp. nov. **Plate 4, fig. 36.**

Membrana non metabolica, hyalina et tenuissima; cellula late ovalis in sectione triquetra, apice modice attenuata et obtusa, latere fere parallelis, apice rotundata; vacuola contractilis magna, spharica, fronte; nucleus in medio cellulae; flagellum 1 fronte cellulae longius; movet porro, repente. Hab. 2 in detritus. Affinis *Petalomonas Steinii* Klebs.

215. **PETALOMONAS SPIRALIS** sp. nov. **Plate 4, fig. 37.**

Membrana non metabolica, hyalina et non striata; cellula oblonga folioformis depressa, spiraliter curvata, apice fronte, papillata, latere concava, apice rotundata; vacuola contractilis fronte, minor; vacuola secundare 2 magna, lucida, in parte posteriore et anteriore; flagellum 1 fronte, rectum, 0.5 cellulae longius; nucleus fere centralis; cellula lg. 29 mi., lt. 11 mi. Hab. 2 in detritus.

216. **PETALOMONAS REPENTES** sp. nov. **Plate 4, fig. 38.**

Membrana firma, hyalina, tenuissima, non striata; cellula ovata cum apicibus attenuatis et acutis; in sectione non depressa; nucleus magna, ovata in medio cellulae; vacuola contractilis parte anteriore; vacuola secundare 3–4; flagellum 1 distincte, recta, cellulae longius; movet repente porro; cellula lg. 18 mi., lt. 7 mi. Hab. 2.

217. **PETALOMONAS GLABRA** nom. nov. **Plate 4, fig. 39.**

*P. sinica* Skvortzow in Jour. Orient. Med. (1932) 4, fig. 4, non P. Arch. Hydrob. 20 (1929) 322, fig. 2.

Cellula fronte ovalis non metabolica, 8.5–9.5 mi. lg., vertice depressa; flagellum 1, principale, duplo cellulae longius; movet repente porro; vacuolae numerosae. Hab. In detritus in aquis stagnalibus prope urbam Mukden, Manshuria.

218. **PETALOMONAS BARANOVII** sp. nov. **Plate 4, fig. 40.**

Cellula fronte late ovalis vel fere triangularis, 18 mi. lg., 2 mi. lt. apice attenuata, a tergo lato-rotundata, 3–4 lobata; vertice depressa, lineari-lanceolata; cytoplasma duriuscula, 3–4 jugata; vacuola principalis in apice; nucleus in medio cellulae; flagellum 1 principale fere duplo cellulae longius; movet repente. Dedico hanc species A. I. Baranov, botanico, Charbin. Affinis *Petalomonas mira* Awer. Hab. 1.

**219. PETALOMONAS EVOLO sp. nov.** **Plate 4, fig. 42.**

Cellula non metabolica, ovalis, fronte acuminata, a tergo late-rotundata, dorso glabra, ventre compressa, sectione reniformis; flagellum 1 fronte, duplo cellulae longius; movet repente porro; nucleus medianus; vacuola numerosae; cellula lg. 11 mi., lt. 7 mi. Hab. 1.

**220. PETALOMONAS PISIFORMIS sp. nov.** **Plate 4, fig. 43.**

Cellula fronte visa ovato-fusiformis, fronte acuminata, a tergo acuta vel obliqua, obtusa; in sectione depressa triangulata, 17 mi. lg., 8 mi. lt; membrana non metabolica, hyalina; vacuola 2–3 rotundatae; nucleus in medio cellulae; flagellum in fronte, cellulae longiora; motio porro repente. Affinis *Petalomonas Baranovi* sp. nov. Hab. 1.

**221. PETALOMONAS SUBELLIPTICA sp. nov.** **Plate 4, fig. 44.**

Cellula fronte visa subelliptica, a tergo obliqua, apice late-rotundata, lateribus magis arcuatis, 15 mi. lg., 10 mi. lt.; in sectione depressa, ovalis; membrana non metabolica, hyalina; vacuola centralis magna; nucleus in medio cellulae; vacuola contractilis pone; flagellum 1 cellulae aequilongum. Affinis *Petalomonas glabra* sp. nov. Hab. 1.

**222. PETALOMONAS ORNATA sp. nov.** **Plate 4, fig. 45.**

Cellula fronte visa ovalis, a tergo late-rotundata, in sectione subrotunda, levissime depressa; cellula 11 mi., lg., 7 mi. lt.; membrana non metabolica; nucleus centralis; vacuola contractilis in fronte, vacuola secundariae ovales, numerosae; flagellum 1.5 cellulae longiora; nutrimentum saprophyticum. Hab. 1.

**223. URCEOLUS PENARDI nom. nov.**

*U. cylostomus* Penard non Stein et Mereschk. in PASCHER u. Lemmermann, Flagel. 2 (1913) 163, figs. 382 non 339.

**224. HETERONEMA FUSIFORMIS sp. nov.** **Plate 4, fig. 46.**

Cellula setacea erecta, apicibus attenuata, metabolica, irregulariter convexa et curvata; membrana non striata; vacuola contractilis fronte, elongata; nucleus elongatis a tergo; flagellum 2, apice; principale erecta, ⅔ cellulae longius, secundare vel trachendi recta 0.5 cellulae longius; movet porro repente; cellula lg. 37 mi. Hab. 2. Affinis *Hetronema acutissimum* Lemm.

**225. HETERONEMA ROBUSTA sp. nov.** **Plate 4, figs. 47, 48.**

Membrana metabolica, hyalina, non striata; cellula ovata vel sphaerica, vel elongata, cum apicibus attenuatis, vel depressis; fronte papillata et hyalina; nucleus hyalina vel atro-purpurea in medio cellulae; granulae paramylacea ovalis,

numerosae, minoris; vacuola una sphaerica a tergo postitae; vacuola contractilis fronte non visa; flagellum 2, apice, principale recta vel modice curvata, 1⅓ cellulae longius; flagellum secundariae cellulae longius vel longior etiam recta; cellulae lg, 55 m., lt. 3 mi. Hab. 2. Affinis *Heteronema nebulosum* (Duj.) Klebs.

**226. HETERONEMA MEDUSÆ sp. nov.** **Plate 4, fig. 49.**

Membrana metabolica, tenuissima et non striata, irregulariter cum granulis ornata; cellula oblonga, obovata fusiformia, lageniformis; parte anteriore attenuata, apice abrupta, posteriore acuta vel acutissima; vacuola contractilis fronte; vacuola secundarae vel nutrimentum numerosae; nucleus in medio cellulae; flagellum 2 apice, principale cellulae longius; secundariae ½ cellulae longius; movet porro; nutrimentum animali simile; cellula lg. 30 mi., lt. 18–20 mi. Hab. 2.

**Genus ALINIELLA novum**

Cellula non metabolica, adhaerenses; membrana duriuscula, crebra; flagellum 2, a fronte principale, a tergo secundare, natandi; vacuola contractilis 1–2; organum baculiforme (Staborgan) adest vel abest; cellula dividerunt in motione; sporae ignoti. Generis *Heteronema* Stein affinis, exquo differt cellulae non metabolicis. Dedico hanc generis V. N. Alin, zoologo, Charbin.

**227. ALINIELLA ELLIPTICA gen. et sp. nov.** **Plate 5, fig. 12.**

Cellula longe-ovata vel subelliptica, 14 mi., lg., 10 mi. lt., non metabolica; membrana duriuscula, latere non compressa; flagellum principale vel natandi cellulae longius; flagellum secundare vel trahendi dimidio cellulae longius; vacuola principalis 1, secundariae numerosae; nucleus non visa; cellula divederunt in motione; nutrimentum saprophyticum; organum bacilliforme adest. Hab. 1.

**228. ALINIELLA GRACILIS sp. nov.** **Plate 5, fig. 13.**

Cellula subelliptica, in medio latisimma, pone paulo angustata, fronte conica, latere non compressa, 15–18 mi. lg., 9–11 mi. lt.; membrana cytoplasmae tenuissima, hyalina, non metabolica; flagellum principale rectiusculum cellulae fere longius; flagellum 1.5 cellulae longiora; organum baculiforme (Staborgan) abest; vacuola principalis magna, fronte; nucleus inter apicem et medium positus; vacuola secundariae numerosae a tergo; nutrimentum saprophyticum. Hab. 1.

229. ALINIELLA SALTANS sp. nov. Plate 5, fig. 14.

Cellula elongata, pone cuneata, basi rotundata, in sectione non compressa; membrana tenuissima non metabolica; organum baculiforme (Stabouran) et vacuola contractilis pone; vacuola secundariae numerosa; flagellum 2, apice cellulae longius, basale duplo longius; motio repente et saltans; cellula lg. 22 mi., lt. 15 mi. Hab. 1.

230. ANISONEMA DEPRESSA sp. nov. Plate 5, fig. 1.

Membrana hyalina, non metabolica et non striata; cellula ovata, parte anteriore attenuata et acuta, parte posteriore late rotundata; sectione depressa; organum baculiforme (Staborgan) abest; vacuola contractilis numerosae, pone; flagellum 2, principale cellulae longius, secundare 3 cellulae longius; cellula lg. 18 mi., lt. 8–10 mi. Hab. 2. Affinis *Anisonema saltans* sp. nov., differt cellulae ovalis et sectione depressis.

231. ANISONEMA OVATA sp. nov. Plate 5, fig. 2.

Membrana non metabolica, hyalina, fronte visa 3 striata; cellula ovalia cum polis rotundatis; nucleus in medio cellulae; vacuola contractilis fronte; organum baculiforme (Staborgan) nullo; vacuola secundare numerosae, minor, apice; sectione depressa et ovalia flagellum principale ⅔ cellulae longius, secundariae 1.5 cellulae longius; cellula lg. 19 mi., lt. 12 mi. Hab. 2. Affinis *Anisonema bryophyta* sp. nov.

232. ANISONEMA IGNORATA sp. nov. Plate 5, fig. 4.

Membrana metabolica, hyalina et non striata; cellula elongata, modice obliqua, apicibus attenuatis et rotundatis; sectione depressa vacuola contractilis apice, secundariae pone; nucleus in medio cellulae; flagellum 2, principale 0.5 cellulae longius, secundariae duplo longius; cellula lg. 11 mi., lt. 6 mi. Hab. 2.

233. ANISONEMA SPHÆRICA sp. nov. Plate 5, fig. 5.

Membrana modice metabolica, hyalina et striata; cellula late ovalia vel sphaerica, in parte mediana plicata; fronte visa acuta cum vacuola contractilis; nucleus centralis, magna; vacuola secundariae numerosae; flagellum 2 fronte, principale cellulae longius, secundariae duplo cellulae longius; cellula lg. 33–37 mi. Hab. 2.

234. ANISONEMA GRACILIS sp. nov. Plate 5, fig. 6.

Membrana non metabolica, hyalina et non striata; cellula elongato ovata, apicibus modice attenuata et rotundata, vertice depressa; vacuola contractilis fronte; vacuola secundariae pone;

nucleus in medio cellulae; flagellum principale 0.5 cellulae longius, secundariae duplo longius; cellula lg. 15 mi., lt. 7 mi. Hab. 1.

**235. ANISONEMA DAPHNIÆ sp. nov.** **Plate 5, figs. 15, 17.**

Cellula ovalis, inaequilateralis, ventre levissime convexa, dorso valde convexa et rotundata, basi breviter caudata; cellula latere compressa et non metabolica; flagellum 2, principale fere cellula longius, secundariae cellulae (1.3) sesqui longius; vacuola contractilis indistincta; cellula lg. 15 mi., lt. 7 mi. Affinis *Anisonema ovale* Klebs, Hab. 1.

**236. ANISONEMA CAUDATA sp. nov.** **Plate 5, fig. 16.**

Cellula elongata vel elongato-ovalis, 18 mi. lg., 10 mi. lt.; membrana metabolica, tenuissima, saepe apice caudata; flagellum 2, principale vel natandi ½ cellulae longiora, secundare cellulae (1.5) sesqui longius; vacuola contractilis pone, secundariae 2–3, magna. Hab. 1.

**237. ANISONEMA PULCHRA Skv. (1836) var. MINOR var. nov.** **Plate 5, fig. 24.**

Cellula ovalis, vacuola contractilis pone, 22 mi. lg., 10 mi. lt. Differt a typo cellulae duplo minoribus. Hab. 1.

**238. ANISONEMA BRYOPHYTA sp. nov.** **Plate 5, fig. 22.**

Cellula fronte oblonga, 25–28 mi. lg., 14 mi. lt. apice subconica, pone late rotundata, a vertice compressa late ovata; membrana duriuscula, firma et non metabolica; cytoplasma densa, 5-jugata; organum baculiforme (Staborgan) abest; nucleus magnus, oblongus in medio cellulae positus; vacuola principalis juxta apicem; flagellum 2, principale fere cellulae longius, secundariae cellulae (1.5) sesqui longius; nutrimentum saprophyticum. Hab. 1.

**239. ANISONEMA BRYOPHYTA sp. nov. var. CURTA var. nov.** **Plate 5, fig. 3.**

Cellula curvata, sectione ovalia et undulata; cellula lg. 22 mi., lt. mi. Hab. 2.

**240. ANISONEMA HYEMALE sp. nov.** **Plate 5, fig. 23.**

Cellula elongato-ovalis, 18 mi. lg., apice attenuata, pone rotundata membrana metabolica, hyalina non striata; organum baculiforme (Staborgan) distinctum; nucleus in medio cellulae; vacuola principalis 1 magna, secundariae numerosae, minores; flagellum 2, principale cellulae (1.5) sesqui longius, secundare cellulae aequilongum; nutrimentum animali simile. Hab. 1.

**241. ENTOSIPHON DEPRESSUM sp. nov.** **Plate 5, fig. 25.**

Cellula fronte visa elongato-ovalis, 30 mi. lg., 12 mi. lt.; apice acuta vel constricta, pone rotundata vel convexa; vertice

compressa rhomboidea cum apicibus acutis; membrana non metabolica, hyalina, indistincte striolata; flagellum apice 2, principale ad ⅔ cellulae longius, secundare duplo crassior, paulo longius vel fere cellulae longius; vacuola principalis inter apicem et medium posita; organum baculiforme (Schlundrohre) litoralis fere cellulae longius; vacuola secundariae numerosae. Hab. inter *Zygnema* sp. et *Diatomaceæ* in stagnis prope Charbin.

**242. ENTOSIPHON ABRUPTUM sp. nov.** **Plate 5, fig. 27.**

Cellulae fronte ovalis, apice lato-rotundata et concava, postice, postice paullulo acuminata, 14 mi. lg., 8 mi. lt.; vertice depresso-ovata, non metabolica; nucleus in medio cellulae; organum baculiforme (Schlundrohre) ad ¼ cellulae longius; vacuola principalis non visa; secundariae numerosae; flagellum 2 in apice cellulae instructa, principale cellulae longius, secundare cellulae sesqui longius. Hab. 1.

**243. ENTOSIPHON ELLIPTICUM sp. nov.** **Plate 5, fig. 7.**

Membrana firma, hyalina et non striata; cellula elliptica cum polis rotundatis, in sectione depressa; organum baculiforme curta; vacuola contractilis et flagellum fronte; flagellum principale cellulae longiora, recta, secundariae 1.2 cellulae longius; vacuola secundariae numerosae; nucleus centralis; movet porro repente; cellula lg. 18–26 mi., lt. 9–11 mi. Hab. 2.

**244. ENTOSIPHON ROTUNDATUM sp. nov.** **Plate 5, fig. 8.**

Membrana non metabolica, hyalina, tenuissima et striata; cellula late ovalis, apicibus late rotundatis, vertice leniter depressa; flagellum 2 fronte aequilonga, cellulae longius; organum baculiforme (Schlundrohre) in medio cellulae, ⅔ cellulae longiora; nucleus centralis; vacuola contractilis apice et 2 lateralis in medio cellulae; vacuola secundariae numerosae, pone; movet porro; cellula lg. 22 mi., lt. 15 mi. Hab. 2. inter *Najas*.

**245. ENTOSIPHON NOVUM sp. nov.** **Plate 5, fig. 9.**

Membrana firma, hyalina, modice longitudinaliter striata; cellula oblonga, apicibus rotundatis, parte posteriore latior, sectione ovato-depressa; vacuola contractilis fronte; nucleus fere centralis; organum baculiforme (Schlundrohre) in medio cellulae, ⅔ cellulae longius; flagellum 2 fronte, aequilonga, cellulae longius cellula 25 mi lg., 11 mi. lt. Hab. 2. Affinis *Entosiphon ovatum* Stokers.

## CHRYSOMONADINÆ

**246. UROGLENOPSIS ROTUNDATA sp. nov.** **Plate 6, fig. 53.**

Coenobia sphaerica, lamellosa, 16 cellulalaria, 18–20 mi. in diam. cellulae late ovalis vel orbiculata, 5–6 mi. lg.; chloroplastae

1, globosum, viridi-lutescens, arcte adhaerens; granulae oleosa numerosae; membrana glabra, hyalina; flagellum 2 non aequilonga. Affinis *Uroglenopsis americana* Lemm. Hab. 1.

## CRYPTOMONADINÆ

**247. CHROOMONAS HYEMALE sp. nov.** **Plate 6, fig. 54.**

Cellula subglobosa, postice lato rotundata, apicibus abrupto-rotundatis; chloroplastae 1 parietalis; stigmate nullo; nucleus in medio cellulae; vacuola contractilis 1, fronte; flagellum 2, inaequalia; granuli amylacei numerosae; cellula lg. 18 mi., lt. 11 mi. Affinis *Chroomonas pulex* Pascher. Hab. 1.

**248. CHILOMONAS ABRUPTA sp. nov.** **Plate 6, fig. 52.**

Cellula subelliptica, firma, pola anteriore late-rotundata non concava; posteriore conica et acuminata, 22–26 mi. lg., 10–11 mi. lt.; lateribus concavis vel uno concavo, duabus levissime convexis; chloroplastae nullo; nucleus centralis; granulae amylacea numerosae, marginalibus; flagellum 2, cellulae longiora. Affinis *Chilomonas oblonga* Pascher. Hab. 1.

## PANTOSTOMATINÆ

**249. MASTIGAMŒBA VARIABILIS sp. nov.** **Plate 6, fig. 1.**

Cellula sphaerica vel late ovalis, 8–11 (13) mi. lg., levissime compressa; membrana firma, tenuissima, paulo granulata; fronte cuneata, basi major metabolica; flagellum 1, fronte insertum, tortuosum, cellulae sesqui (1.5) vel ad ⅓ longius; movet porro; vacuola contractilis fronte; vacuola secundariae numerosae; nucleus in medio cellulae; cellula dividerunt in motione; nutrimentum animali simile. Hab. 1.

**250. MASTIGAMŒBA PYRIFORMIS sp. nov.** **Plate 6, fig. 2.**

Cellula pyriformis vel sphaericis; membrana metabolica; pseudopodia curta, simplicia, rotundata, allea partis cellulae instructae vacuola contractilis pone; flagellum cellulae longius vel longiora; motio porro, lente; cellula lg. 14.8 mi., lt. 18 mi. Hab. 1.

**251. MASTIGAMŒBA MINUTA sp. nov.** **Plate 6, fig. 3.**

Cellula fere stellata; membrana tenuissima, major metabolica; pseudopodia simplicia, apice, base et latere instructa; vacuola contractilis pone; vacuola secundariae numerosae; flagellum 1, cellulae longius; motio porro, repente, lente; cellula lg. 7.4 mi. Affinis *Mastigamoeba longifolium* Stokes. Hab. 1.

**252. MASTIGELLA BRYOPHYTA sp. nov.** **Plate 6, fig. 4.**

Cellula ovalis, non retusa, 15–20 mi. lg.; membrana hyalina omnis valde metabolica; pseudopodia simplicia, minora, numerosae; flagellum 1 integrum, cellulae longius; movet repente; nutrimentum animali simile. Differt *Mastigella nodosæ* sp. nov. pseudopodiis numerosae. Hab. 1.

**253. MASTIGELLA NODOSA sp. nov.** **Plate 6, fig. 5.**

Cellula fere sphaerica vel late ovalis non retusa, 18–20 mi. lg.; membrana tenuissima, hyalina, metabolica; pseudopodia simplicia, nasutaeformes; nucleus et vacuolae in medio cellulae; flagellum 1, interdum cellulae aequilongum vel ejus sesquilongius, tenuissimum; apice flagelli maximo mobilis; movet repente; nutrimentum animali simile. Hab. 1.

**254. CERCOBODO CAUDATA sp. nov.** **Plate 6, fig. 9.**

Cellula lato ovalis, apice attenuata, pone lato rotundata, 7–18 mi. lg. et 7 mi. lt.; vertice sphaerica vel triangulata; membrana metabolica cum pseudopodiis simplicibus; nucleus in medio cellulae; vacuola principalis 1, secundariae aliquot; flagellum 2, principale cellulae aequilongum vel ejus duplo longius, secundare cellulae (1.5) sesqui longius; movet porro. Hab. 1.

**255. CERCOBODO BACILLIFAGA sp. nov.** **Plate 6, fig. 10.**

Cellula fere sphaerica vel late ovalis, 11–12 mi. lg.; membrana metabolica; nucleus centralis; vacuolae numerocae; flagellum 2, principale et secundare cellulae longius. Hab. 1.

**256. CERCOBODO CONSTRICTA sp. nov.** **Plate 6, fig. 8.**

Cellula ovalis, parte mediana constricta, 22 mi. lg., 7.4 mi. lt.; membrana metabolica; pseudopodia absunt; flagellum 2, principale cellulae aequilongum, secundare cellulae (1.5) sesquilongius; nucleus in medio cellulae; vacuolae numerosae. Differt *Cercobodo mucilaginosa* Skv. (1946) forman cellulae. Hab. 1.

**257. CERCOBODO MUSCOSA sp. nov.** **Plate 6, fig. 7.**

Cellula fronte visa elongata-ovalis, recta vel curvata; apice attenuata, pone late rotundata, 11–18 mi. lg., 5–8 mi. lt.; membrana metabolica, tenuissima, hyalina; nucleus in medio cellulae; vacuola principalae 2, secundariae numerosae; flagellum 2, principalae ad ⅔ longitudinis cellulae longius, secundare cellulae aequilongum; movet repente; nutrimentum animali simile. Hab. 1.

**258. CERCOBODO BARBATA sp. nov.** **Plate 6, fig. 11.**

Cellula subsphaerica, ovalis, elongata, 3.5–11 mi. lg., 3.5–7.5 mi. lt.; fronte lato rotundata, basi rotundata vel attenuata;

membrana tenuissima, metabolica; nucleus in medio cellulae; vacuola principalis 1, secundariae numerosae; pseudopodia lateralia, vel basalia filiformia vel rotundata, ¼–1–2–3 longitudinis cellulae aequilonga; flagellum 2, principale cellulae longius, secundare cellulae sesqui (1.5) longius. Affinis *Cercobodo mucilaginosa* Skv., *C. caudata* sp. nov. et *C. minuta* sp. nov. Hab. 1.

**259. CERCOBODO METABOLICA sp. nov.** **Plate 6, fig. 6.**

Cellula lato-ovalis non depressa, 14 mi. lg., 6–7 mi. lt; apice attenuata, pone lato rotundata; membrana metabolica; vacuola contractilis in apice, secundariae numerosae; flagellum 2, principale et secundare duplo cellulae longiora. Affinis *Cercobodo muscosa* sp. nov. differt cellulae adpressis. Hab. 1.

**260. CERCOBODO LEMMERNANNII sp. nov.** **Plate 6, fig. 46.**

Cellula minuta, elliptica; membrana metabolica, tenuissima, in sectione non constricta, apicibus attenuatis, rotundatis, 7.4 mi. lg., 3.7 mi. lt; nucleus centralis; vacuola contractilis indistinctis, vacuola secundariae numerosae; flagellum 2, fronte ½ cellulae longiora, basale cellulae aequilonga; movet porro repente. Hab. 1.

**261. CERCOBODO REPENS sp. nov.** **Plate 6, fig. 13.**

Cellula oblonga vel ovalis apicibus rotundatis, 7–8 mi. lg., 3–4 mi. lt.; membrana metabolica, distincta et hyalina; latere sphaerica non depressa; nucleus in medio cellulae, organum baculiforme (Staborgan) abest; vacuola principalis 2, magnae, secundariae numerosae, minore flagellum 2, principale cellulae aequilongum, secundare duplo cellulae longius; nutrimentum saprophyticum. Hab. 1.

**262. BODO SAPROPHYTORA sp. nov.** **Plate 6, fig. 14.**

Cellula fronte visa lato ovalis in sectione plana, 14–15 mi. lg., lt.; membrana non metabolica; nucleus in medio cellulae; vacuola aliquot; organum baculiforme (Staborgan) abest; flagellum 2, frontale cellulae brevius et basale 1.5 cellulae longius; movet repente porro; nutrimentum saprophyticum. Hab. 1.

**263. BODO ELLOPTORA sp. nov.** **Plate 6, fig. 15.**

Cellula fronte ovalis apicibus rotundatis, 14 mi. lg., 7 mi. lt; in sectione plana; membrana non metabolica; nucleus in medio cellulae positus; vacuola principalis 2, magnae vacuola secundariae numerosa, flagellum 2, frontale cellulae brevius et basale cellulae longius; movet repente porro. Hab. 1.

**264. BODO OVALIS sp. nov.** **Plate 6, fig. 16.**

Cellula fronte lato ovalis, 14 mi. lg., 7–10 mi. lt. apice attennuata, pone late rotundata; latere compressa, dorso lato rotundata, vertice levissime triangulata; membrana non metabolica, hyalina, glabra nucleus in medio cellulae; vacuola aliquot; organum baculiforme (Staborgan) abest; flagellum 2, fere aequilonga cellulae (1.5) sesquilongiora; movet repente, Hab. 1.

## PROTOMASTIGINÆ

**265. OICOMONAS CAUDATA sp. nov.** **Plate 6, fig. 17.**

Cellula elongato-ovalis, 15 mi. lg., 1 mi. lt., apice attenuata, 10–15 mi, lg.; latere lato-rotundata vel compressa; membrana metabolica; nucleus in medio cellulae; vacuola principalis 1 magna, secundariae numerosae, minores; flagellum 1; nutrimentum animali simile; cellula libere natantes vel rarior sessiles in substrato agglomeratae. Affinis *Oicomonas socialis* Moroff. Hab. 1.

**266. OICOMONAS RUGOSA sp. nov.** **Plate 6, fig. 18.**

Cellula lato ovalis vel rotundata, 11–12 mi. in diam.; membrana non metabolica, hyalina, rugosa; vacuola 2 magnae, secundariae numerosae; nucleus,; flagellum 1, cellulae duplo longius; affinis *Oicomonas termo* Martin, differt cellulae rugosis et flagellum duplo longiore. Hab. 1.

### Genus LOUKASHKINA novum

Cellula ovalis, fronte attenuata, a tergo lato rotundata; membrana cellulae firma; flagellum 1.; vacuola contractilis fronte 1, vacuola secundariae numerosae; nucleus in medio cellulae; sporae ignotae; nutrimentum saprophyticum vel animali simile. Affinis generis *Oicomonas* S. Kent, differt cellulae firmis non metabolicis. Dedico hanc generis A. S. Loukashkin, zoologo, Charbin (1928–35).

**267. LOUKASHKINIA OVATA gen. et sp. nov.** **Plate 6. fig. 19.**

Cellula lato ovalis, fronte attenuata, a tergo lato rotundata, 7–14 mi. lg., 3–7(8) mi. lt.; membrana firma, hyalina; vacuola contractilis fronte, secundariae numerosae; flagellum 1 fronte cellulae duplo vel duplo semis longius; movet repente. Hab. 1.

**268. LOUKASHKINIA NATANS sp. nov.** **Plate 5, fig. 20.**

Membrana hyalina, tenuissima et non metabolica, modice striata; cellula ovata, parte anteriore attenuata et rotundata, parte posteriore late rotundata; sectione non depressa; nucleus in medio cellulae vacuola contractilis fronte; vacuola secundariae

numerosae; flagellum 1 rectum cellulae longius; movet porro; nutrimentum animali simile; cellula lg. 18–25 mi., lt. 11 mi. Hab. 1.

**269. LOUKASHKINIA VACUOLARIS sp. nov.** **Plate 5, fig. 46.**

Membrana tenuissima, firma non metabolica et, non striata; cellula late ovalis, fronte modice attenuata, a tergo lato-rotundata, sectione depressa; vacuola contractilis minor, indistinctis, fronte; vacuola secundariae numerosae; flagellum cellulae longius; nucleus non vidi; movet porro, rotante; nutrimentum saprophyticum; cellula lg. 37 mi., lt. 15 mi. Hab. 2.

**ANCYROMONAS (S. Kent) Emend.**

Cellula hyalina, firma vel metabolica, retusa vel non retusa, natantes vel sessilis; flagellum 1 curtum vel longum; motio porro repente; vacuola contractilis adsunt; nutrimentum saprophyticum vel animali semile; cellula dividerunt in motione; sporae ignotae.

**270. ANCYROMONAS SOCIALE sp. nov.** **Plate 6, fig. 20.**

Cellula elongato-elliptica, oblonga, dorso rotundata, ventre concava, 3–4 mi. lg., 1.5–2 mi. lt., non metabolica; flagellum 1 natantes vel sessilis; cellula triplo longius; vacuola contractilis 1 in medio cellulae; cellula dividerunt in motione. Hab. 1.

**271. ANCYROMONAS ABRUPTA sp. nov.** **Plate 6, fig. 21.**

Cellula 3.5–4 mi. lg., 2–2.5 mi. lt., non metabolica, elongata, obliqua, apice cuneata, basi rotundata tumida et abrupta; flagellum 1, natantes vel sessilis; cellulae duplo (2–2.5) vel duplo semis longius; vacuola 1–3(4); nutrimentum saprophyticum. Affinis *Ancyromonas sociale* sp. nov. Hab. inter muscis in cortice *Piceæ* sp., Manshuria borealis.

**272. ANCYROMONAS ROTUNDATA sp. nov.** **Plate 6, fig. 22.**

Cellula sphaerica, 1.5–2(3) mi. in diam., non metabolica; flagellum 1 cellulae duplo (2–2.5) vel duplosemis longius; vacuola principalis 1, magna, secundariae numerosae; nucleus in medio cellula; movet porro, rapide; cellula dividerunt in motione. Hab. 1, cum *Ancyromonas abrupta* sp nov.

**273. ANCYROMONAS MINUTA sp. nov.** **Plate 6, fig. 23.**

Cellula fronte obovata, latere retusa, 5–6 mi. lg., 2–2.5 mi. lt., non metabolica; flagellum cellulae sesqui vel duplo (1.5–2) longius vacuola contractilis in medio cellulae; nutrimentum saprophyticum; movet porro. Hab. 1.

**274. ANCYROMONAS RUGOSA sp. nov.** **Plate 6, fig. 24.**

Cellula elongato triquetra, latere rugosa, fronte laeve rotundata, apice attenuata, in sectione rotundata, 10–12 mi. lg., 6–7 mi. lt.; flagellum I cellulae duplo (2) longius; movet porro: rotante. Hab. 1.

**275. ANCYROMONAS PRIMA sp. nov.** **Plate 6, fig. 25.**

Cellula sphaerica vel fere triquetra, 6–7 mi. in diam.; membrana tenuissima, levissime metabolica; flagellum 1, cellulae triplo vel quadruplo (3–4) longius; vacuola numerosae, fere in medio cellula movet per saltus; cellula dividerunt in motione; nutrimentum animali simile. Hab. 1.

**276. ANCYROMONAS METABOLICA sp. nov.** **Plate 6, fig. 26.**

Cellula late ovalis, 12 mi. lg., 7–8 mi. lt.; valde metabolica; membrana tenuissima et hyalina; flagellum 1 cellulae aequilongum; vacuola fere in medio cellulae; movet porro repente. Hab. 1.

**277. ANCYROMONAS NITZSCHIÆ sp. nov.** **Plate 6, fig. 27.**

Cellula ovalis, 25–26 mi. lg., 14 mi. lt.; membrana tenuissima, metabolica; flagellum 1, cellulae sesqui (1.5) longius; vacuola in medio cellulae cum frustulis *Nitschiæ* sp. inclusis; motio porro repente; nutrimentum animali simile. Hab. 1.

**278. ANCYROMONAS LATA sp. nov.** **Plate 6, fig. 28.**

Cellula obovata vel triquetra et obliqua, 14–15 mi. lg., 5–8 mi. lt., fronte cuneata, basi rotundata vel truncato-rotundata; membrana tenuissima et metabolica; flagellum 1, curtum cellulae sesqui (1.5) long movet tarde porro; vacuola contractilis fronte, secundariae numerosae; nutrimentum animali simile. Hab. 1.

**279. LEPTOMONAS PISCIFORMIS sp. nov.** **Plate 6, fig. 29.**

Cellula elongata, fusiformis, 12 mi. lg., 4 mi. lt.; fronte rostrata, apice attenuata et rotundata; membrana firma, tenuissima, non metabolica et non striata; flagellum 1 natantis, cellulae sesqui (1–1.1/5) longius; motio porro; vacuola principalis fronte, magna, secundariae minores, numerosae; nucleus in medio cellulae; nutrimentum saprophyticum. Hab. 1.

**280. LEPTOMONAS LATA sp. nov.** **Plate 6, fig. 30.**

Cellula elongato-ovalis, 11 mi. lg., 5 mi. lt.; membrana non metabolica, tenuissima, non striata; fronte rostrata, apice acuta; vacuola contractilis fronte, secundariae numerosae; flagellum 1 cellulae aequilongum; movet porro; nutrimentum saprophyticum. Hab. 1.

**281. MONOSIGA ROTUNDA sp. nov.** **Plate 6, fig. 31.**

Cellula sphaerica, sine lorica 6–7 mi in diam.; membrana hyalina; nucleus in medio cellulae; collum 3–3.5 mi. lg.; ore everso; flagellum differt *Monosiga ovata* S. Kent. cellulæ sphaericis et cellulis brevioribus. Hab. 1.

**282. DINOMONAS FEROX sp. nov.** **Plate 6, fig. 32.**

Cellula fere ovalis, 10–12–14 mi. lg.; cytoplasma hyalina; flagellum 2 apice cellulae inserta, aequilonga; cellulae sesquilongiora; motiones natantes vel amoeboides-repentes; pseudopodia simplicia; vacuola contractilis numerosae; nutrimentum animali simile. Hab. 1.

**283. DIMONONAS SIMPLEX sp. nov.** **Plate 6, fig. 33.**

Cellula orbicularis vel fere orbicularis, 7–12 mi. in diam.; non metabolica; membrana tenuissima; nucleus in medio cellulae; vacuola 1–4; flagellum 2, apice cellulae inserta, cellulae aequilonga vel longius; nutrimentum animali simile; motio maxime lente. Hab. 1.

**284. DINOMONAS ROTUNDA sp. nov.** **Plate 6, fig. 34.**

Cellula sphaerica, 5.5 mi. in diam; membrana tenuis, non metabolica; flagellum 2 apice cellulae inserta, aequaliter duplo semis (2.5) cellulae longiora; nucleus in medio cellulae; vacuola apice; movet rapide *Chlamydomonadis similiter;* nutrimentum animali simile. Hab. 1.

**285. DINOMONAS PLANCTONICA sp. nov.** **Plate 5, figs. 18, 19.**

Membrana firma non metabolica, hyalina et tenuissima; cellula sphaerica vel ovalis; flagellum 2, rigidum, aequilongum, cellulae longiora vel (1.5) sesqui longius, natantes; vacuola contractilis fronte; vacuola secundariae magna, numerosae, sphaericae; nutrimentum animali simile (Chlamydomonadaceae) ; movet porro, rotante; cellula lg. 14–19 mi., lt. 14 mi. Hab. 2.

**286. SALPINGŒCA ULOTRIX sp. nov.** **Plate 6, fig. 56.**

Cellula semi orbiculata et sessilis, 11 mi. lata; colla teberosa, 18 mi. lg., 3.5 mi. lt. Hab. 2, in *Ulotrix* sp.

**Genus SPIROMONAS novum**

Membrana tenuissima hyalina, firma vel metabolica cum pseudopodia; cellula libere natantis, ovalia, obovata, oblonga vel obliquae triquetra; flagellum 2, fronte aequilonga, cellulae longius; nucleus in medio cellulae; vacula contractilis fronte; vacuola secundariae 1–5; nutrimentum animali simile in cellulae *Spirogyra* sp. Differt generis *Dimononas* S. Kent (Bodonaceæ) cellulae parasitis in *Spirogyrae.*

**287. SPIROMONAS SPIROGYRÆ gen. et sp. nov.** **Plate 6, figs. 63, 64.**

Cellula sphaerica-ovata vel oblonga, fronte attenuata, basi late rotundata; flagellum 2 fronte; cellula 5–18 mi. lg., 3–9 mi. lt; nutrimentum animali simile. Hab. 2 in cellulae *Spirogyrae* sp.

**288. BODO COMMUNIS sp. nov.** **Plate 6, fig. 35.**

Cellula sphaerica vel fere sphaerica, cum membrana tenuissima et non metabolica, 3.7–5 (7.4) mi. in diam.; flagellum 2 innaequalia principale sesqui vel duplo (1.5–2) cellulae longius, secundariae triplo vel quadruplo (3–4) cellulae longius; nucleus in medio cellulae; vacuola 1–4; kineten vacuolae nullo; movet per saltens; cellula dividerunt in motione. Affinis *Bodo globosus* Stein. Hab. 1.

**289. BODO MINUTA sp. nov.** **Plate 6, fig. 12.**

Cellula valde minutae, 4 mi. diam., lato-ovatae, in sectione non constrictae, partibus apicalibus et basalibus valde dilatatis et rotundatis; membrana non metabolica, laeves, tenera; nucleus in medio cellulae; vacuolae 2–4; nutrimentum bacteriale; flagellum 2-frontale cellulae (1.5) sesqui longius et posterious item cellulae (1.5) sesqui longius; movet porro. Hab. 1.

**290. BODO PHASEOLUS sp. nov.** **Plate 6, fig. 36.**

Cellula oblonga vel ovalis, 5–6 mi. lg., apice oblonga, pone rotundata; flagellum 2 apice cellulae instructa, principale ⅔ longitudinis cellulae longius, secundare fere duplo (2) cellulae longius; vacuola contractilis non nihil inter apicem et medium cellulae postitae. Hab. 1.

**291. BODO FRIGIDA sp. nov.** **Plate 6, fig. 37.**

Cellula sphaerica, 5 mi. in diam.; membrana tenuissima, metabolica, apice attenuata, pone lato rotundata; flagellum 2 apice inserta, unum cellulae (1.5) sesqui longius, secundum paulo brevius, reflexum; vacuola supra medium positae; nucleus?; motiones tremulae. Hab. 1.

## AMPHIMONADACEÆ

*Clavis generis Amphimonadaceæ*

A. Cellula firma.
a. Cellula non depressa ..... *Amphimonas* Duj.
aa. Cellula depressa ..... *Foliomonas* gen. nov.
AA. Cellula metabolica ..... *Serpentomonas* gen. nov.

**292. AMPHIMONAS EPIPHYTA sp. nov.** **Plate 6, fig. 38.**

Cellula sphaerica, 4–4.5 mi. in diam.; epiphytica, sessilis; membrana tenuissima, metabolica; vacuola 2; nucleus in medio cellulae; flagellum 2 non aequilonga, duplo vel duplo semis (2–2.5)

cellulae longiora; nutrimentum saprophyticum. Differt a *Amphimonas globosa* S. Kent. cellulae sessilibus. Hab. 1.

**293. AMPHIMONAS GLOBOSA S. Kent. forma.** **Plate 6, fig. 39.**

Cellula sphaerica vel late ovalis, 6–7 mi. in diam.; membrana tenuissima non metabolica; flagellum 2, fronte instricta, duplo cellulae longiora et a tergo petiolus filiformis habet; vacuola 2–3 in medio cellulae; movet per motionem flagelli et petioli, repente quam forma typica minor. Hab. 1., cellulae aggregatae, epiphyticae et fasciculatae.

**Genus FOLIAMONAS novum**

Membrana tenuissima, firma non metabolica; cellula fronte visa elongato-triquetra; parte anteriore truncata, angulis rotundatis lateribus cuneatis, parte posteriore acutis vel rotundatis; nucleus centralis, vacuola contractilis minor, fronte; vacuola secundariae numerosae, latere depressa linearia, modice curvata; flagellum 2 aequilongum, cellulae longius, fronte; movet porro rotante. Differt generis *Amphimonas* Duj. cellulae depressis.

**294. FOLIAMONAS TRIQUETRA gen. et sp. nov.** **Plate 6, fig. 57.**

Cellula 11–12 mi. lg., 4–5 mi. lt.; nutrimentum saprophyticum. Hab. 2.

**Genus SERPENTOMONAS novum**

Membrana hyalina tenuissima, saepe granulata, modice metabolica; cellula variabilia, elongato vel oblonga, spiraliter curvata vel recta; fronte abrupto-obliquae vel incisa, lateribus obliquiis vel curvatis, vel parte mediana constrictis, apice late-rotundata vel rotundato-acuta; nucleus in medio cellulae; flagellum tenuissimum 2 fronte insertum, aequilongum; movet libere natantes porro repente non rotante; vacuola contractilis a tergo et in apice cellulae; nutrimentum animali simile. Affinis generis *Amphimonas* Duj. differt membrana metabolicas.

**295. SERPENTOMONAS NATANS gen. et sp. nov.** **Plate 6, fig. 62.**

Cellula lg. 10–15 mi., lt. 6–8 Hab. 2, inter *Mougeotia* sp.

## PROTOMOSTIGINÆ

### TETRAMITACEÆ

**Genus KUZMINIA novum**

Cellula fronte visa ovalis, apice incisa, pone acuta, latere compressa; membrana rigida non metabolica, longitudinaliter striata; flagellum 4, aequilonga, apice, nucleus in medio cellulae; vacuola numerosae; differt generis *Collodictyon* Carter cellulae compressis incisis. Dedico hanc generis V. I. Kuzmin, botanico. Charbin (1935–50).

**296. KUZMINIA INCERTA gen. et sp. nov.** **Plate 6, fig. 40.**

Cellula 18–20 mi. lg., 10 mi. lt. sectione compressa; flagellum 4, aequilonga, cellulae (1.5) sesquilongiora; vacuola numerosae; nucleus in medio cellulae; movet rotante porro; nutrimentum saprophyticum. Hab. 1.

## DISTOMATINÆ

**297. TREPOMONAS VOLANS sp. nov.** **Plate 6, fig. 41.**

Cellula fronte visa lato ovalis vel sub ovalis, 5–7 mi., lg., 3 mi. lt.; latere compressa, superna capitata, fissure obliqua instructa; membrana tenuissima non metabolica; flagellum 6, lateralia; motiones rotuntes, salta bundae et volantes; nutrimentum saprophyticum. Affinis *Trepomonas Steini* Klebs. Hab. 1.

**298. HEXAMITUS ABRUPTA sp. nov.** **Plate 6, fig. 42.**

Cellula ovalis, 6–7 mi. in diam., fronte rotundata, a tergo concava; membrana tenuissima non metabolica; flagellum 8, lateralia 4, natanti, basalia 4, duplo cellulae longiora; vacuola in medio cellulae; nutrimentum saprophyticum. Affinis *Hexamitus inflatus* Duj. Hab. 1.

**299. HEXAMITUS CORNUTA sp. nov.** **Plate 6, figs. 44, 45, 55.**

Membrana tenuissima, firma, non metabolica; cellula ovalia vel spiraliter tortuosa; parte anteriore lato concavo, lateribus rotundatis, jugatis, jugis curvatis, apicibus attenuatis et acutis; sectione depressa, elongato-curvata; nucleus in medio cellulae; flagellum principale vel natantes 6, parte anteriore, lateribus, secundariae vel trahendi 2, pone; movet porro et rotante, rapide; nutrimentum saprophyticum; cellula lg. 14–15 mi. Hab. 2.

## DINOFLAGELLATÆ

**300. PROROCENTRUM MANSHURICUM sp. nov.** **Plate 5, fig. 28.**

Cellula orbicularis, sectione non compressa; poria flagelli in medio papilla instructa; textas rigida, brunnea, foveolata, parte anteriore incrassata; chromotophora brunnea, viridia, nemerosæ; flagellum cellulae duplo longius; nucleus ovalis, magnus. Hab. in planctone lacus alkslini prope stationem Sartu, Manshuria borealis, 20/10/51.

**301. HEMIDINIUM BRYOPHYTICUM sp. nov.** **Plate 5, fig. 29.**

Cellula variabilis, orbicularis vel ovalis, a lateribus levissime compressa; ringulum obliquum non completum, laterale; nucleus fere centralis; chromatophora nullum; cytoplasma hyalina; vacuola abest; movet porro repente et rotante; flagellum duplo cellulae longius; cellula lg. 14–22 mi., lt. 14 mi. Hab. 1.

**302. HEMIDINIUM MUCOSUM sp. nov.** **Plate 5, fig. 21.**

Membrana firma; cellula fronte visa ovalis, parte anteriore et posteriore rotundata; ringulum lateralis non completum rectum non obliqua, in sectione late ovalis; cytoplasma hyalina; vacuola numerosae; nucleus in medio cellulae; stigma prope nuclues; flagellum 2–3 cellula longius; lg. 14.5, lt. 9 mi. Hab. 2.

**303. HEMIDINIUM OCCULATUM sp. nov.** **Plate 5, fig. 26.**

Membrana tenuissima, firma; cellula ovalia, parte anteriore capitata, dorso late rotundata, ventre parte anteriore fissura obliqua instructa; parte posteriore rotundata, vertica visa rotundata; chloroplastis discoideis, brunnea; nucleus centralis; stigma juxta apicem; vacuolum numerosae; cellula lg. 11 mi., lt. 8 mi. Hab. 2.

**304. AMPHIDINIUM ACHROMATICUM sp. nov.** **Plate 5, fig. 39, 40.**

Membrana tenuissima, hyalina et non metabolica; cellula rotundata, sectione non depressa; apicibus rotundatis; epivalva semirotundata, non capitata et non nasuta, 7 mi. lg., 20 mi. lt.; hypovalva late rotundata 25 mi. lt.; nucleus in medio cellulae; chloroplastae nullo; vacuola 2–3 major, hyalina; granulis oleosa numerosae, minor stigma juxta nucleus; flagellum 1, duplo cellulae longius. Hab. 2.

**305. AMPHIDINIUM ELENKINI Skvortzow.** **Plate 6, fig. 43.**

*A. Elenkini* Skvortzow in Russ. Hydrobiol. Zeitsch. 4 (1925).

Membrana tenuissima, hyalina; cellula subglobosa, vertice depressa epivalva lato depressa 2 mi. lg. 10–12 mi. lt. 8; hypovalva late rotunda a tergo concava, sulcus distinctis in epivalva insertus, acutis; chloroplastae brunnea, minor, abest vel nullum; stigma nullo; nucleus in medio cellulae; granulae amylacea vel oleosa numerosa. Hab. in stagnis prope Charbin.

**306. AMPHIDINIUM VERNALE Skvortzow.** **Plate 6, fig. 60.**

*A. vernale* Skvortzow in Species novae . . . (1946) 13. Plate 1, figs. 1, 2.

Membrana tenuissima et hyalina; cellula subglobosa, vertice non depressa; epivalva lata, modice truncata, 4 mi. lg., 15 mi. lt.; hypovalva late rotundata, 17 mi. lg., 20 mi. lt.; nucleus in medio cellulae; chloroplastae brunnea-viridis; granulae numerosae (amylacea?); stigma nullum; flagellum ⅔ cellulae longius. Hab. 2.

**307. AMPHIDINIUM NASUTUM sp. nov.** **Plate 6, fig. 65.**

Membrana tenuissima, hyalina et non striata; cellula fronte late rotundata; epivalva recta, nasuta, hyalina, apice rotundata, 4 mi. lg. et lt; hypovalva late rotundata; nucleus magna,

centralis; chloroplastae viridia, granulis obscurae, minor et numerosae; vacuola minor; stigma nullum; flagellum 2–3 cellulae longius; movet rapide. Hab. 2.

**308. AMPHIDINIUM ALINII sp. nov.** **Plate 6, fig. 59.**

Cellula late ovalis vel cylindrica, fronte posticeque vulgo late-rotundata; epivalva rhombica, nasuta, hyalina, 7 mi. lg., 5.5 mi. lt., superne obtusa; hypovalva cylindrica, apice rotundata, 22 mi. lg.; membrana hyalina; chloroplastae numerosae, glauca; flagellum cellulae duplo longius; stigma non vidi; movet porro rapide et rotanti. Hab. 1. Dedico hanc species V. N. Alin, zoologo, Charbin. Hab. In stagnis prope Harbin.

**309. GLENODINIUM ABRUPTUM sp. nov.** **Plate 5, fig. 30**

Cellula late ovalis non compressa; epivalva et hypovalva fere aequilongae; epivalva conica cum poris apicalibus; hypovalva late-rotundata, pone obliqua; ringulum levissime spirale laevorsum; sulcus in epivalva insertus acutis, ad hypovalvae cylindricis pone apertus; membrana hyalina; lg. 15 mi., lt. 13 mi. Hab. 1.

**310. GLENODINIUM MINUTUM Skvortzow.** **Plate 5, fig. 31.**

*G. minutum* SKVORTZOW in Species novae. . . anno 1931–45 descrip. (1946) 13, Plate 1, fig. 4.

Cellula rotundari-ovalis, membrana hyalina; epivalva et hypovalva aequilongae; sectione compressae dorseventralis; sulcus et ringulum indistincta; chloroplast viride; cellula lg. 22 mi., lt. 18 mi.; quam typus duplo major. Hab. 1.

**311. GLENODINIUM COSMARIÆFORME sp. nov.** **Plate 5, fig. 32.**

Cellula ventre ovalis; sectione reniformis, dorsoventralis; membrana hyalina; epivalva et hypovalva aequilonga, rotundatae; pone angustata; ringulum et hypovalva indistincta; chloroplast viride; flagellum non vidi; cellula lg. 33 mi., lt. 40 mi. Hab. 2.

**312. GLENODINIUM ROTUNDATUM sp. nov.** **Plate 5, fig. 34.**

Cellula ventre ovalis fere orbicularis, levissime compressa: membrana hyalina; epivalva et hypovalva fere aequilongae; ringulu obliquum levissime levorsum spirale; sulcus indistinctus ad hypovalva concavus; chloroplastae brannea, numerosae; flagellum non vidi; cistae in involucro crasso mucilaginoso instructae; cellula lg. 33–58 mi., lt. 33–57 mi. Hab. 1.

**313. GLENODINIUM VIRIDE sp. nov.** **Plate 5, fig. 33.**

Cellula late-ovalis; membrana hyalina; epivalva acute-rotundata, hypovalvae longior; hypovalvae late-rotundata, paullulo acuminata, ringulum laterale, ventrale et dorsale, distinctum;

sulcus obliquus; cellula dorso valde compressa, in sectione reniformis; nucleus elongato-reniformis, magnus in medio epivalvae positus; chloroplastae viridia, numerosa, discoidea, parva; stigma non visa; cellula lg. 22–51 mi., lt. 18–40 mi. Hab. 2.

**314. GLENODINIUM TURFOSUM sp. nov.** **Plate 5, fig. 35.**

Cellula late ovalis, membrana hyalina, tenuis; epivalva latorotunata, hypovalvae major; hypovalva apice levissime acuminata; ringulum latere, ventrale vel dorsale, latum; sulcus indistinctus; cellula a dorso valde compressa; chloroplastae brunnea, numerosa, discoidea; nucleus fere sphaericus magnus fere medio cellulae insertus; stigma et flagellum absunt; cellula 29 mi., lt. 14 mi. Hab. 1.

**315. GLENODINIUM SUNGARIENSE sp. nov.** **Plate 5, fig. 44.**

Cellula pyriformis, lateribus compressis; epivalva hypovalvae multo major; in sectione reniformis; epivalva cum 7 tabulae frontalis equatorialis, 1–2 tabulae apicalis, 1 tabula mediana; hypovalva cum 5 tabulae posterior equatorialis, 1 tabula antiapicalis; ringulum pauci-spirale; sulcus in epivalva et hypovalva paulo evolutus; tabulae hyalinae; chloroplastae non vidi. Hab. 1.

**316. GLENODINIUM MAJALE sp. nov.** **Table 5, fig. 36.**

Cellula pyriformis, lateribus compressis; epivalva hypovalvae multo major; epivalva cum 5 tabulae frontalis equatorialis, 1 tabula apicalis, 1 tabula mediana; hypovalva cum 4 tabulae posterior equitorialis, 1 tabula antiapicalis; sulcus et ringulum a lo dens in *Peridinio Smirnovi* simile; chloroplastae brunnea; sulcus apice cum spina; cellula lg. 148 mi., lt. 74 mi. Hab. 2.

**317. GLENODINIUM MALIAVKINI sp. nov.** **Plate 5, figs. 37, 38.**

Cellula ovaliformis cum pora apicalis; epivalva conica hypovalvae pauci major; hypovalva pone obliqua; ringulum latum spirale; sulcus distinctis in epivalva, minor, in hypovalva dilatatus; epivalva cum 7 tabulae frontalis equitorialis marginalis, 1–3 tabulae apicalis, 2 tabulae mediana; hypovalva cum 4–5 tabulae posterior equatorialis, et 1 tabula antiapicalis; tabulis planis vel concavis, hispidis vel tantum secus suturis hispidis; suturae latae cellula lg. 37–48 mi., lt. 33–37 mi. Hab. 2. Dedico hanc species A. G. Maliavkin, Presidenti Sc. Harbinensis pro Invest. Naturae et Ethnogr.

**318. PERIDINIUM SMIRNOVII sp. nov.** **Plate 5, figs. 41, 42.**

Cellula fronte visa late-ovalis vel pyriformis vel fere sphaerica (fo. *orbicularis* f. nov., Tab. 5. fig. 42); in sectione compressa, dorsoventralis, cum pora apicalis; ringulum multo spirale; epivalva hypovalvae major cum 4–5 tabulae frontalis

equatorialis marginalis, 3 tabulae apicalis, 1–3 tabulae mediana; sulcus distinctus ad ½ epivalva protractus in hypovalva dilatatus; hypovalva cum 5 tabulae posteriore equatorialis et 2 tabulae antiapicalis; tabulae saepe concavae, granulata; suturae latae, striolatae; tabula antiapicalis bicornuta, *Peridinio bicepte* Stein similis; sulcus parte apicale cornutus; chloroplastae numerosa; nucleus magnus; lg. 120–50 mi., lt. 50–80 mi., lt. 50–80 mi. Hab. 2. Dedico hanc species A. M. Smirnov. geologo, Charbin.

322. **HYPNODINIUM ASIATICUM sp. nov.** **Plate 5, fig. 43.**

Cellula fere sphaerica, epivalva et hypovalva aequilongae et conformes; membrana hyalina; ringulum in lateribus ventrale et dorsale distinctum; sulcus indistinctis; cellula a dorso valde compressa; chloroplastae brunnneum; stigma oblonga a tergo hypovalva posita; nucleus reticulatus; flagellum nullo; cellula lg. et lt. 33 mi. Affinis *Hypnodinium sphaerico* Klebs. Hab. 1.

323. **CERATIUM CORNUTUM (Ehr.) Cl. et Lactm.** **Plate 5, fig. 45.**

Cellula major et compressa, dorsoventralis cum cornibus longis 3; cornu frontale obliquum; epivalva aequilongum cum pora apicali cornu posterius rectum; cornu laterale apice curvatum; membrana tabulata et verrusosa; ringulum spirale; chloroplastae brunneum; cellula lg. 148 mi.; lt. 74 mi. Species in terpositus inter *Ceratium carolineanum* (Baily) Jorg. et *Ceratium cornutum* (Ehr.) Cl. I. Lactm. Hab. 1.

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# ILLUSTRATIONS

[Redrawn from the author's originals by M. Santiago.]

## Plate 1

Fig. 1. *Printziella biflagellata* gen. et sp. nov.
2. *Pyramidomonas variabile* sp. nov.
3. *P. abdida* sp. nov.
4. *P. abnato* sp. nov.
5. *P. hyalina* sp. nov.
6. *Carteria striata* sp. nov.
7. *C. lacustris* sp. nov.
8. *C. sinica* Skv.
9. *C. obovata* sp. nov.
10. *C. polychloris* Pascher.
11. *Chlamydomonas phaseolus* Skv.
12. *C. biarticulata* sp. nov.
13. *C. bifrons* sp. nov.
14. *C. involucrata* sp. nov.
15. *C. apicala* sp. nov.
16. *C. pyriformis* sp. nov.
17. *C. Pascheriana* (Skv.) nom. comb. nov.
18. *C. subglobosa* Skv.
19. *C. asiatica* Skv.
20. *C. paludosa* Skv.
21. *C. oblonga* sp. nov.
22. *C. convexa* sp. nov.
23. *C. inflata* sp. nov.
24. *C. armata* sp. nov.
25. *C. laeve* sp. nov.
26. *C. compacta* sp. nov.
27. *C. libera* sp. nov.
28. *C. bullata* sp. nov.
29. *C. stigmata* sp. nov.
30. *C. granulata* sp. nov.
31. *C. lunata* sp. nov.
32. *C. ampula* sp. nov.
33. *C. Franki* Pascher.
34. *C. cava* sp. nov.
35. *C. Printzii* sp. nov.
36. *C. parallelistriata* Korsch.
37. *C. erecta* sp. nov.
38. *C. tumida* Skv.
39. *C. pseudo Dangeardi* sp. nov.
40. *C. ocellata* Skv.
41. *C. prolifera* sp. nov.
42. *C. dilatata* sp. nov.
43. *C. bursiculaeformis* sp. nov.
44. *C. obiqua* sp. nov.
45. *C. recta* sp. nov.
46. *C. pulchra* Skv.
47. C. *fluviatilis* sp. nov.
48. *C. microscopia* G. S. West.
49. *C. manshurica* Skv.
50. *C. cistula* sp. nov.
51. *C. minor* sp. nov.
52, 53. *C. Shawi* Skv.
54. *C. foveola* sp. nov.
55. *C. ovata* Dang.
56. *C. papillata* sp. nov.
57. *C. baccata* sp. nov.
58. *C. areolata* sp. nov.
59. *C. fragilis* sp. nov.
60. *C. stagnalis* Skv.
61. *C. abbreviata* sp. nov.
62. *C. solida* Skv.
63. *C. plena* sp. nov.
64. *C. protracta* sp. nov.
65. *C. maculata* Playf.
66. *C. aestivata* sp. nov.
67. *C. Fritschi* Skv.
68. *C. multiplex* sp. nov.

## Plate 2

Fig. 1. *Chlamydomonas superiora* sp. nov.
2. *C. dissimilis* sp. nov.
3. *Chlorogonium obliquum* Skv.
4. *C. acutissimum* sp. nov.
5. *C. tenuissimum* sp. nov.
6. *C. vernale* sp. nov.
7. *C. acuminatum* sp. nov.
8. *C. minutum* sp. nov.
9. *Sphaerellopsis ovalis* sp. nov.
10. *S. elongata* sp. nov.
11. *S. asiatica* sp. nov.
12. *Thorakomonas Korschikovi* sp. nov.
13. *T. quadrata* sp. nov.
14. *T. asiatica* sp. nov.
15. *T. obovata* sp. nov.
16. *Lobomonas rostrata* Hazen.
17. *Diplostauron phacus* sp. nov.

18. *Coccomonas planctonica* Skv.
19. *C. cordiformis* Skv.
20. *Arnoldiamonas bispinosa* gen. et sp. nov.
21. *A. ocellata* sp. nov.
22. *A. compressa* nom. nov.
23. *A. phaseolus* sp. nov.
24. *Pedinoptera Nadsonii* Skv.
25. *Gordejeviella nigra* gen. et sp. nov.
26. *Phacotus hyalina* sp. nov.
27. *P. asiaticus* sp. nov.
28. *P. oblongus* sp. nov.
29. *Pteromonas foliosa* sp. nov.
30. *P. trigustra* sp. nov.
31. *P. cylindrica* sp. nov.
32. *P. rhombica* sp. nov.
33. *P. rotundata* sp. nov.
34. *P. armata* sp. nov.
35. *P. undulata* sp. nov.
36. *P. rotantes* sp. nov.
37. *P. planctonica* sp. nov.
38. *P. caudata* sp. nov.
39. *P. spinosa* sp. nov.
40. *P. simplex* sp. nov.
41. *P. longicollis* sp. nov.
42. *P. obtusa* nom. nov.
43. *P. incurva* nom. nov.
44. *P. incisa* sp. nov.
45. *P. sucordiformis* sp. nov.
46. *Wislouchiella planctonica* skv.

PLATE 3

FIG. 1. *Pteromonas acuta* sp. nov.
2. *P. Korschikoffi* Skv.
3. *P. angulosa* Lemm. var. *elongata* Skv.
4. *P. cornuta* Skv.
5. *P. rugosa* sp. nov.
6. *P. conspersa* Skv.
7. *Tetreblepharis orbiculata* sp. nov.
8. *Polytoma acuta* sp. nov.
9. *P. longociliata* sp. nov.
10. *P. subcylindrica* sp. nov.
11. *P. communis* sp. nov.
12. *P. cucumis* sp. nov.
13. *P. curvata* sp.
14. *Hyalogonium hyemale* sp. nov.
15. *Astasia detrita* sp. nov.
16. *A. communis* sp. nov.
17. *Euglena intervolans* sp. nov.
18. *E. messula* sp. nov.
19. *E. orthia* sp. nov.
20. *E. obtusa* sp. nov.
21. *E. bacillaria* sp. nov.
22. *E. lutaria* sp. nov.
23. *E. subacutissima* sp. nov.
24. *E. centrorubra* sp. nov.
25. *E. longuscula* sp. nov.
26. *E. viridis* Ehrenb. var. *hyalina* var. nov.
27. *Phacus anaceolus* Stokes var. nov. *asiatica* var nov.
28. *P. pelta* sp. nov.
29. *P. spinifer* sp. nov.
30. *P. pediformis* sp. nov.
31. *P. rotundata* sp. nov.
32. *P. hyalina* sp. nov.
33. *P. ovalis* sp. nov.
34. *P. circulata* sp. nov.
35. *P. aenigmatica* Drezep. var. *asiatica* var. nov.
36. *P. spiralis* sp. nov.
37. *P. ranae* sp. nov.
38. *P. carinata* sp. nov.
39. *P. triqueter* (Ehr.) Duj. var. *lata* var nov.
40. *P. rapacea* sp. nov.
41. *Lepocinclis sungariensis* sp. nov.
42. *L. ovalis* sp. nov.
43. *L. cordiormis* sp. nov.
44. *L. minor* sp. nov.
45. *L. acuta* sp. nov.
46. *Cryptoglena tumida* sp. nov.
47. *C. cornuta* sp. nov.
48. *C. longicauda* sp. nov.
49. *Colacium trachelomonoides* sp. nov.
50. *Eutreptia stagnalis* sp. nov.
51. *Astasiella peranemiformis* gen. et sp. nov.
52. *Astasia longicauda* sp. nov.
53. *A. dissecta*, sp. nov.
54. *A. longiflagellata* sp. nov.
55. *A. distincta* sp. nov.
56. *A. stigmatella* sp. nov.
57. *A. striata* sp. nov.

PLATE 4

FIG. 1. *Astasia serpenta* sp. nov.
2. *A. tenuissima* sp. nov.
3. *A. repentes* sp. nov.
4. *A. lagenariae* sp. nov.
5. *A. automnale* sp. nov.
6. *Paramylonomonas astasieformis* gen. et sp. nov.
7. *Astasia nutabilis* sp nov.
8. *A. similis* sp. nov.
9. *A. granulata* sp. nov.
10. *Menoidium clavatum* sp. nov.
11. *M. patulum* sp. nov.
12. *M. saevum* sp. nov.
13. *M. incurvum* sp. nov.
14. *M. singulum* sp. nov.
15. *M. euglenae* sp. nov.
16. *M. rapacis* sp. nov.
17. *M. spirillum* sp. nov.
18. *M. depressum* sp. nov.
19. *M. similis* sp. nov.
20. *M. utriculariae* sp. nov.
21. *Menoidiomonas ocullata* gen. et sp. nov.
22. *M. Schewiakoffi* nom. nov.
23. *Distigma papillata* sp. nov.
24. *Ampullamonas repentes* gen. et sp. nov.
25. *A. rotante* sp. nov.
26. *Schewiakowia natantes* gen. et sp. nov.
27. *Mereschkowskiella nasuta* gen. et sp. nov.
28. *Baikovia ferox* gen. et sp. nov.
29. *Peranema hyalina* sp. nov.
30. *P. planctonica* sp. nov.
31. *P. ocellata* sp. nov.
32. *P. acuta* sp. nov.
33. *P. furcata* Skv.
34. *Petalomonas piscator* sp. nov.
35. *P. abrupta* sp. nov.
36. *P. rectangularis* sp. nov.
37. *P. spiralis* sp. nov.
38. *P. repentes* sp. nov.
39. *P. glabra* sp. nov.
40. *P. Baranorii* sp. nov.
41, 42. *P. evolo* sp. nov.
43. *P. pisciformis* sp. nov.
44. *P. subelliptica* sp. nov.
45. *P. ornata* sp. nov.
46. *Heteronema fusiformis* sp. nov.
47, 48. *H. robusta* sp. nov.
49. *H. medusae* sp. nov.

PLATE 5

FIG. 1. *Anisonema depressa* sp. nov.
2. *A. ovata* sp. nov.
3. *A. bryophyta* sp. nov. var. *cutta* var. nov.
4. *A. ignorata* sp. nov.
5. *A. sphaerica* sp. nov.
6. *A. gracilis* sp. nov.
7. *Entosiphon ellipticum* sp. nov.
8. *E. rotundatum* sp. nov.
9. *E. movum* sp. nov.
10. *Petalomonas depressa* sp. nov.
11. *Baranovia stagnalis* gen. et sp. nov.
12. *Aliniella elliptica* gen. et sp nov.
13. *A. gracilis* sp. nov.
14. *A. sultans* sp. nov.
15, 17. *A. daphniac* sp. nov.
16. *A. caudata* sp. nov.
18, 19. *Dinomonas planctonica* sp. nov.
20. *Loukashkinia natans* gen. et sp. nov.
21. *Hemidinium mucosum* sp. nov.
22. *Anisonema bryophyta* sp. nov.
23. *A. hyemale* sp. nov.
24. *A. pulchela* Skv. var *minor* var. nov.
25. *Entosiphon depressum* sp. nov.
26. *Hemidinium occulatum* sp. nov.
27. *Entosiphom abruptum* sp. nov.
28. *Prorocentrum manshuricum* sp. nov.

29. *Hemidinium bryophyticum* sp. nov.
30. *Glenodinium abruptum* sp. nov.
31. *G. minutum* Skv.
32. *P. cosmariæforme* sp. nov.
33. *G. viride* sp. nov.
34. *G. rotundum* sp. nov.
35. *G. turfosum* sp. nov.
36. *G. majale* sp. nov.
37, 38. *G. Maliavkini* sp. nov.
39, 40. *Amphidinium achromaticum* sp. nov.
41, 42. *Peridinium Smirnoyii* sp. nov.
43. *Hypnodinium asiaticum* sp. nov.
44. *Glenodinium sungariense* sp. nov.
45. *Ceratium cornutum* (Ehr.) Cl. et Lactm.
46. *Loukashkinia vacuolaris* sp. nov.

PLATE 6

FIG. 1. *Mastigamoeba variabilis* sp. nov.
2. *M. pyriformis* sp. nov.
3. *M. minuta* sp. nov.
4. *Mastigella bryophyta* sp. nov.
5. *M. nodosa* sp. nov.
6. *Cercobodo metabolica* sp. nov.
7. *C. muscosa* sp. nov.
8. *C. constricta* sp. nov.
9. *C. caudata* sp. nov.
10. *C. bacillifaga* sp. nov.
11. *C. barbata* sp. nov.
12. *Bodo minuta* gen. et sp. nov.
13. *C. repens* sp. nov.
14. *Bodo saprophytiora* sp. nov.
15. *B. elloptora* sp. nov.
16. *B. ovalis* sp. nov.
17. *Oicomonas caudata* sp. nov.
18. *O. rugosa* sp. nov.
19. *Loukashkinia ovata* sp. nov.
20. *Ancyromonas sociale* sp. nov.
21. *A. abrupta* sp. nov.
22. *A. rotundata* sp. nov.
23. *A. minuta* sp. nov.
24. *A. rugosa* sp. nov.
25. *A. prima* sp. nov.
26. *A. metabolica* sp. nov.
27. *A. nitzschiae* sp nov.
28. *A. lata* sp. nov.
29. *Leptomonas pisciformis* sp. nov.
30. *L. lata* sp. nov.
31. *Monosiga rotunda* sp. nov.
32. *Dinomonas ferox* sp. nov.
33. *D. simplex* sp. nov.
34. *D. rotunda* sp. nov.
35. *Bodo communis* sp. nov.
36. *B. phaseolus* sp. nov.
37. *B. frigida* sp. nov.
38. *Amphimonas epiphyta* sp. nov.
39. *A. globosa* S. Kent forma.
40. *Kuzminia incerta* gen. et sp. nov.
41. *Trepomonas volans* sp. nov.
42. *Hexamitus abrupta* sp. nov.
42. *Hexamitus abrupta* sp. nov.
43. *Amphidinium Elenkini* Skv.
44, 45, 55. *Hexamitus cornuta* sp. nov.
46. *Cercobodo Lemmernannii* sp. nov.
47. *Chlamydobotris asiatica* sp. nov.
48. *Valvulina Playferina* sp. nov.
49, 51. *Synura hyalina* sp. nov.
50. S.h. var, *rotundata* var nov.
51. S.h. var. *aculeata* var. nov.
52. *Chilomonas abrupta* sp. nov.
53. *Uroglenopsis rotundata* sp. nov.
54. *Chroomonas hyemale* sp. nov.
55. *Hexamitus cornuta* sp. nov.
56. *Salpingoeca ulotrix* sp. nov.
57. *Foliamonas triquetra* gen. et sp. nov.
58. *Mollomonas rugosa* sp. nov.
59. *Amphidinium Alinii* sp. nov.
60. *A. vernale* Skv.
61. *Synura rotundata* sp. nov.
62. *Serpentomonas natans* gen. et nov.
63, 64. *Spiromonas parasitica* gen. et sp. nov.
65. *Amphidinium nasutum* sp. nov.

PLATE 1.

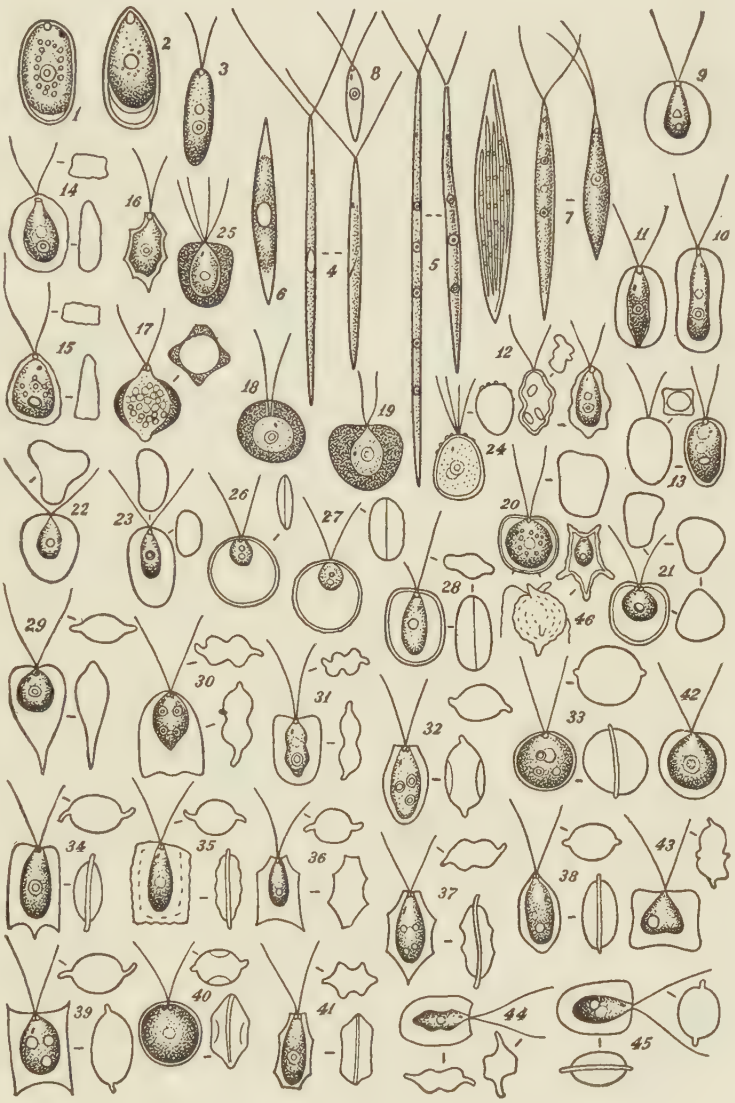
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PLATE 2.

PLATE 3.

PLATE 4.

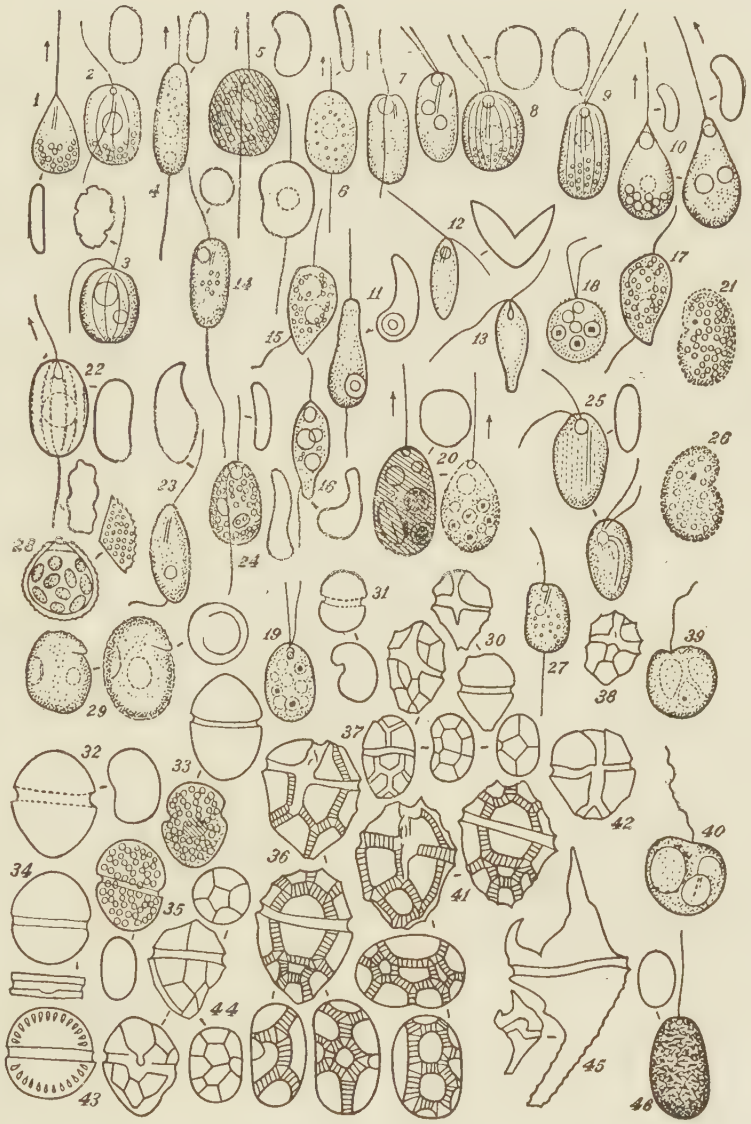

PLATE 5.

PLATE 6.

# RICE 'ACCEP NA PULA' OR STUNT DISEASE—A SERIOUS MENACE TO THE PHILIPPINE RICE INDUSTRY [1]

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FIVE PLATES

The first field survey of rice *accep na pula* disease was made in 1939 at the Buenavista Estate rice fields within the vicinity of the municipality of San Ildefonso, Bulacan Province. This was undertaken primarily to know how serious the disease was and secondarily to gather additional data that would further strengthen the writer's belief that the disease was of virus origin. The survey was extended later to cover the greater portion of the estate, revealing the prevalence of the disease in the barrios of Pulong Tamo, Malipangpang, San Roque, and Telapatio in the municipality of San Idelfonso. In the barrios of Diliman, Kaiñgin, Maronquillo, and Bato-Bato, San Rafael Municipality, the disease was also found but in less virulent form. It was similarly noted in a mild state in the rice fields along the national highway near the municipalities of Bocaue and Bigaa, Bulacan Province.

In January, 1940, when the survey was extended to Southern Luzon provinces, moderate cases of the disease were observed

[1] Part II of a scientific treatise: "Improvement of the Philippine Rice Industry on a Permanent Basis."

[2] The author wishes to express his gratitude to Dr. Marcos Alicante, Director, Soil Conservation Bureau, and to Mr. Jose G. Sanvictores, former General Manager, Buenavista Estate, San Ildefonso, Bulacan, for their encouragement and support which made possible the carrying out of this investigation successfully. No less grateful recognition is also expressed to Mr. Rufino Isidro, now with the Bureau of Agricultural Extension, for the kind help extended in furnishing diseased specimens and analyzing soil samples; and to Mr. S. R. Capco, formerly assistant curator of entomology, National Museum, for the identification of the rice leafhoppers *Nephotettix* spp. Above all, the writer wishes to acknowledge the valuable help and assistance rendered by his former technical staff headed by Mr. Macario Palo, now Chief, Biological Research Division, Institute of Science and Technology, and composed of Messrs. Ambrosio Madamba, Crispin Hernandez, Ramon Samaniego, Arcadio Querijero, Isidro Romero, and Saturnino Posadas; to his present staff and assistants; and to Mr. Honesto Velasco for the photographs used in the illustrations.

widely scattered in the *palagad* plantings or off-season crops between Lumbang and Pagsanjan and Bay Municipalities, Laguna Province. Incidentally, it was in these areas where the leafhoppers *Nephotettix apicalis* Motsch and *Nephotettix bipunctatus cincticeps* Uhler were noted in sizeable numbers particularly in the paddies where stunting, yellowing and reddening of the diseased plants were more or less conspicuous.

The extension of the survey to other Central Luzon provinces revealed that the same disease was found in the western part of Tarlac Province and in the areas covered by the San Jose-Talavera Irrigation System in Nueva Ecija. It was reported to have occurred during the past three years and it is known as *tungro* in Pampango and Iloco. The same disease, locally known as *po-ol* or *po-or* was noted in mild form together with the presence of the rice leafhoppers *Nephotettix* spp. on the *palakaya* or off-season planting in the barrios of San Juan, San Roque, and Flores in the San Manuel Municipality, Pangasinan Province.

The same disease, known as *kadang-kadang* in Bicol, was reported seriously affecting rice fields in Albay Province as early as 1953. This was later verified by Macario Palo who surveyed the region in October, 1940 and collected plants affected with the disease, insect vectors as well as palay seeds of some varieties like Buenavista (Kasungsong) which were found resistant to the disease.

In the latter part of November, 1941 the writer in company with Jose G. Sanvictores, Manager of the Buenavista Estate, found the disease present all over the Northern Luzon Provinces up to Malig plains, Isabela Province. The survey which was intended to cover the Philippines from Aparri to the Bisayan Islands and Mindanao was cut short because of the second World War.

Recent reports indicate that the disease is apparently causing havoc in Negros Occidental Province where it is known as *los-ong* as well as in Santa Barbara, Fabia, Mina, Lucena, Zarraga, and Pototan municipalities, Iloilo Province, where farmers call it *tagostos*. It is known in Bohol as *sebukaw*. The same disease has been reported in Kalawang, Norada, Cotabato.

For nearly 20 years, the accep na pula disease has affected greatly rice areas from the Malig plains, Isabela to the Bicol Regions causing reductions in rice harvests every year. Most

Philippine commercial varieties are susceptible to the disease to a greater or lesser degree. These and the fact that the disease spreads as fast as the natural dispersion of its insect vectors allows it, are, in the writer's opinion, reasons for the Philippine Government to take this economic problem seriously. It should learn from the sad experience of the Japanese when this disease wiped out rice crops in a number of Japanese prefectures causing famine in the affected areas about 73 years ago. Right now the disease seriously infects such provinces as Cavite, Bulacan, Pampanga, Tarlac, Nueva Ecija, Pangasinan, and many others.

In some areas, the disease is such that affected fields are reduced to complete waste and produce nothing. Assuming, therefore, that *accep na pula* disease is causing only 30 per cent damage to our crop, which is rather a conservative estimate, then the present national production of about 74,000,000 cavans of palay should be 105,000,000 cavans at least. This means a total annual loss of around 31,000,000 cavans.

The references covering this malady are rather scanty. Besides the information that the disease was very severe in Japan in 1883, the earliest account which might prove to be on the same subject is the article published in the 1932 Annual Report of the Department of Agriculture of North Borneo(7) which stated that a serious malady has been in existence since 1925 in the districts of Menggotal, Penampang, Weston, and Bundu and was attributed to have been caused by the leafhopper *Nephotettix bipunctatus*. The report also stated that an extract of a certain species of derris was found effective in controlling the pest. Two years later, the same Department of Agriculture(5) reported that the planting of two most resistant varieties like Sabit Temong and Rangon proved to be very effective in reducing the ravages caused by the rice pest. Again, in 1937 the same Department of Agriculture(6) reported the serious recurrence of obviously similar malady in the districts of Penampang, Paper and Membakut which was claimed to have been put under control within a month by light-trapping at night.

In line with this belief, Abalos(1) reported that *N. apicalis* and *N. bipunctatus* were the causes of the rice malady known as *po-ol* or *po-or* in Pangasinan and recommended the control of the pests as a remedial measure.

Agati(2) and Peralta(13) in their studies on the *kadang-kadang* disease of rice in the Bicol Region, reported that this disease has been seriously menacing the rice fields in Albay, Albay Province since 1935 and that, after a more or less thorough study of the nature and cause of the disease, they were inclined to believe that the trouble was caused by a physiological rather than pathological disturbance resulting from malnutrition or insufficiency of nitrogen supply in what they called kadang-kadang soil.

After the completion of a series of transmission experiments, the first progress report stating categorically that accep na pula disease in the Philippines is caused by an infective virus transmitted by the rice leafhoppers *Nephotettix bipunctatus cincticeps* Uhler was submitted on March 15, 1940 by the author(15) to the then Secretary of Agriculture and Natural Resources.

In the light of the results of studies by the author on the important role of rice leafhopper *N. bipunctatus cincticeps* Uhler as the insect vector transmitting the virus causing accep na pula disease of rice in the Philippines, it is logical to presume that the rice malady reported to have been caused by leafhopper *N. bipunctatus* in the State of North Borneo is the same as the accep na pula disease in the Philippines. This belief is strengthened by the fact that nonviruliferous leafhoppers of the same species have been found to be nondestructive of the health and vigor of the rice plants under Philippine conditions. This finding is confirmed by the results obtained by Agati, et al.(3) in their progress report on the rice maladies in Central Luzon which report, incidentally, completely reverses their previous findings and stand on the subject.(2)

## SYMPTOMS OF THE DISEASE

The preliminary studies on the symptoms of the disease were provisionally made on diseased fresh specimens brought by field men to the soil biology laboratories of the former Bureau of Science. Such specimens revealed the characteristic stunted growth of affected plants, as well as the unfailing presence of chlorotic lesions on the youngest leaf. This was accompanied by the yellowing and reddening of leaf starting from the rim proceeding inward to the midrib, the color of which remains darker green than the normal leaf. This reddish hue color of the foliage resulting from advanced stage of infection, befits the descriptive Tagalog name *accep na pula* while 'stunt'

or 'dwarf' denotes the much arrested growth of the plant as a consequence of infection. (Plate 1)

The first visible symptoms of the disease appear in the form of chlorotic yellowish-white lesions developing along the edges of unfolding leaves on young seedlings. These may be seen clearly by holding the leaf up against the light. As the leaf unfolds, these chlorotic lesions spread further to cover the entire leaf particularly along the middle portions of the leaf blades parallel to the midrib. This part assumes a darker green color in contrast to the yellowing, then reddening discoloration of the entire leafblades. All the succeeding leaves would invariably show the same characteristic discoloration and deformation. The older ones which have been formed prior to infection may appear quite normal. Usually, infection at this early stage of seedling development results in the death of affected young plants before tillering starts. This is a manifestation of the high virulence of the disease conditioned, however, by the relative resistance of the host plant, at its age at the time of infection as well as the volume of the insect vector population.

When infection takes place on fairly well developed plants, on two to two and one-half months old plantings, the manifestation of the disease is ordinarily confined to the tillers which develop subsequent to infection. The older tillers may develop to maturity and produce panicles which to a casual observer may appear normal and free from disease. This is especially true if the variety happens to possess a high degree of resistance to the pathogene. If the infected tillers produce panicles, such panicles would be abortive, deformed and with grains equally emaciated and discolored. On the other hand, if the variety is highly susceptible as the Canoni, the whole field may totally be infected and reduced to a complete waste despite the late infection. (Plate 2)

Diseased plants have the tendency to produce darker green color on their fully developed foliage so much so that they look greener than the normal healthy plants. Finally, they turn dark orange or reddish brown, then start severe drying towards the tips of the leaves, signifying the slow but certain breakdown. Diseased plants become severely stunted because growth subsequent to infection is very much arrested. Many infected plants develop numerous diminutive tillers with chlorotic and itiolated small leaves, producing a rosette appearance

fittingly called 'rosetting'. This excessive abnormal tillering resembles the excessive cell reproduction in the cancerous organs and tissues of man. At this juncture, it may be stated that future researchers may succeed in showing that cancer in man is caused by a certain infective virus and the excessive cell reproduction in both is the offshoot of a titanic strife for the host's survival. This observation seems to be substantiated by the fact that more cases of 'rosetting' are seen on late infections where the plants involved had previously acquired substantial resistance to fight the malady's intrusion although at the end they all succumb to it. (Plate 3)

Stunt-infected fields when ratooned show the presence of the disease in a more virulent form. In fact, the disease which appears as mild on the plant crops becomes as moderate to severe on the ratoon crop which develops from the stubbles of the first crop. It is in ratoon crops too where more cases of 'rosetting' are observed and the relative resistance or susceptibility of a variety is revealed in the barest form. (Plate 4)

## ETIOLOGY OF THE DISEASE

Diseased specimens show the characteristic symptoms which lead to the conclusion that an infective virus is the cause of the disease. This is further strengthened by the common observation of farmers in infected areas, particularly at the Buenavista Estate, Bulacan Province, that accep na pula disease appears in September and October following that preponderance of the leafhoppers in the rice fields during the most active phase of the rice plant's growth and development. These give the farmers reasons to believe that the leafhoppers (locally known as *pisek-pisek, kutitap,* or *hanip ñg palay*) cause the disease. On the other hand, a segment of our farming population still entertains the false belief that stemborers cause accep na pula disease. This is an imprint made by previous reports which turned out to be erroneous.

*Materials and methods.*—Living disease specimens and suspected insect vectors were collected from the *palagad* plantings in between the towns of Lumbang and Pagsanjan, Laguna Province and reared separately in insect-proof wire cages at the back yard of the former Bureau of Science. Thirty-two Philippine leading rice varieties including those introduced from foreign countries were collected. With these materials the author conducted his experiments.

*First transmission tests.*—Healthy young seedlings of Apostol raised in insect-proof wire cages were used in these tests. At the age of 2 weeks, 150 seedlings were transplanted in 30 pots (empty gasoline cans) filled with soil from stunt-infected fields in San Ildefonso Municipality, Bulacan Province. Five seedlings were in each pot—one in each corner and the fifth at the middle. The pots were then distributed equally in 6 insect-proof wire cages ($1.25 \times 1.25 \times 2.25$ m), following the same arrangement as in the planting of the seedlings in each pot. Two weeks later, when the seedlings appeared robust, healthy and green, 5 smaller insect-proof wire cages (of the size to fit snugly the rim of the pots) each containing 5 adult leafhoppers *N. apicalis* Motsch were inverted one by one into each pot, thereby introducing the leafhoppers into the seedlings in each pot in cage 1. Simultaneously and with exactly the same procedure and technique but using *N. bipunctatus cincticeps* Uhler the transmission test was extended to another set of 25 potted seedlings in cage 2. Two hours later, following exactly the same technique, the leafhoppers in cage 1 were transferred to cage 3 while the leafhoppers in cage 2 were transferred to cage 4. After the lapse of 24 hours, all the leafhoppers in cages 3 and 4 were collected separately and were put back to their respective breeding cages 'A' and 'B' where stunt-infected rice plants were kept for future use. The 50 potted seedlings in cages 5 and 6 were left alone as check. The results are given in Table 1, Series 1.

*Second transmission tests.*—These tests were conducted with two objectives in view, namely: first, to explain the apparent disappearance of the leafhoppers *Nephotettix* spp. during the summer months in regions where no second crop of rice is raised for lack of irrigation water, and how they tide-over during the period; and second, to unravel the mystery of the annual recurrence of the disease despite the apparent disappearance of the insect vector. These tests revealed for the first time that the rice leafhoppers *Nephotettix* spp. continue to exist all the year round by estivation as fully developed nymphs during summer months, subsisting on drought-resistant grasses, which serve as intermediary hosts, especially those growing along irrigation canals and ditches. When the early rain comes, the fully developed nymphs in estivation molt into adult leafhoppers which then start laying eggs on rice seedlings to begin their life cycle anew. The rain provides the optimum

moisture and atmospheric humidity required for normal biological changes and growth.

The procedure and technique of transmission used here were the same as those adopted in the first series but Wagwag was used instead of Apostol. The results are given in Table 1, Series 2.

*Third transmission tests.*—To check the author's belief that kadang-kadang disease of rice in the Bicol Region was identical to accep na pula in Bulacan and other neighboring provinces was the purpose of these tests. Living diseased rice plants together with living specimens of the rice leafhopper *N. bipunctatus cincticeps* were collected from Albay Province in October, 1940, after the results of the first and second tests were known. Palay seeds of the varieties displaying a high degree of resistance to the disease were also collected from the same region. These tests were then carried on with the same number and age of potted seedlings placed in 6 insect-proof wire cages. Exactly the same procedure and technique followed in the first tests were used, replacing Apostol with Elon-elon and *N. apicalis* Motsch with *N. bipunctatus cincticeps* Uhler, one set collected from Albay and one from Bulacan, and allowing the leafhoppers to feed on diseased plants coming from their respective provinces. The results of the tests are indicated in Table 1, Series 3.

*Fourth transmission tests.*—Field observations throughout the infected regions pointed to the fact that rice varieties reacted differently to accep na pula disease under varied conditions of soil, climate, and culture, especially as regards their individual capacities for resisting the infiltration of the malady. It was therefore, necessary to find the degree of resistance of each variety to determine the concrete, effective and cheap measures necessary to control the disease. For this purpose, comparative tests among the 32 leading rice varieties including those introduced from foreign countries were conducted.

A lot of 8,000 sq. m. in the Buenavista Estate, San Ildefonso Municipality, Bulacan Province, was divided into 160 plots of 50 sq. m. each. Every plot was planted in 5 replications to young seedlings of the 32 selected varieties. Planting was done with one seedling per hill spaced 20 $\times$ 20 centimeters. In view of the fact that the soil in the experimental field was eroded, the first replication was treated with complete fertilizer (16–20–10) at the rate of 150 Kg. per Ha; the second, with

TABLE 1.—*Transmission of 'Stunt' or 'Dwarf' disease of rice by the leaphopper "Nephotettix bipunctatus cincticeps" Uhler and its artificially reproduced typical symptoms—descriptive of the real accep na pula disease.*

| Series number | Date of transmission | Variety | Number of plants | | Kind of insects | Source of insects | Number of insect per plant | Number of feeding hours | Number of plants infected | Incubation period (days) | Degree of infection | Symptoms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Treated | Check | | | | | | | | |
| 1: A- | 11-28-39 | Apostol | 25 | 0 | *N. apicalis* | Laguna | 1 | 2 | 0 | 0 | Healthy | Normal and green |
| B- | do | do | 25 | 0 | *N. bipunctatus* | do | 1 | 2 | 18 | 8-12 | Moderate | Stunted and yellowing |
| C- | do | do | 25 | 0 | *N. apicalis* | do | 1 | 24 | 0 | 0 | Healthy | Normal and green |
| D- | do | do | 25 | 0 | *N. bipunctatus* | do | 1 | 24 | 22 | 7-10 | Severe | Stunted and reddening |
| E- | do | do | 0 | 25 | None | None | 0 | 0 | 0 | 0 | Healthy | Normal and green |
| F- | do | do | 0 | 25 | do | do | 0 | 0 | 0 | 0 | do | do |
| 2: A- | 4-24-40 | Wagwag | 25 | 0 | Nymphs | Bulacan | 1 | 2 | 10 | 8-12 | Moderate | Stunted and yellowing |
| B- | do | do | 25 | 0 | do | do | 1 | 24 | 15 | 8-10 | Severe | Stunted and reddening |
| C- | do | do | 0 | 25 | None | None | 0 | 0 | 0 | 0 | Healthy | Normal and green |
| 8: A- | 10-19-40 | Elon-elon | 25 | 0 | *N. bipunctatus* | Albay | 1 | 2 | 20 | 8-11 | Moderate | Stunted and yellowing |
| B- | do | do | 25 | 0 | do | Bulacan | 1 | 2 | 20 | 8-11 | do | do |
| C- | do | do | 25 | 0 | do | Albay | 1 | 24 | 25 | 7-10 | Severe | Stunted and reddening |
| D- | do | do | 25 | 0 | do | Bulacan | 1 | 24 | 25 | 7- 9 | do | do |
| E- | do | do | 0 | 25 | None | None | 0 | 0 | 0 | 0 | Healthy | Normal and green |
| F- | do | do | 0 | 25 | do | do | 0 | 0 | 0 | 0 | do | do |

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TABLE 2.—*Transmission of 'Stunt' or 'Dwarf' disease of rice by the leafhopper "Nephotettix bipunctatus cincticeps" Uhler under open field conditions and the resistance displayed by some varieties as influenced by fertilizer treatment.*

| Index number | Variety | Number of plants per plot | Leafhopper used [1] | Approximate number of leafhoppers per plant | Number of feeding hours (minimum) | Approximate incubation period (days) | Fertilizer treatment (N-P-K)[3] | Degree of infection | Average yield in cavans per hectare | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Individual | General |
| 1– | Apostol | 1,250 | *N. bipunctatus* | 2.2 | 48 | 8–11 | 16–20–10 | Slight | 56.10 | |
| | | | | | | | 16–20– 0 | do | 50.50 | |
| | | | | | | | 20– 0– 0 | Moderate | 34.00 | |
| | | | | | | | 0–10– 0 | do | 35.50 | |
| | | | | | | | | Severe | 25.00 | 40.22 |
| 2– | Buenavista | 1,250 | do | 2.5 | 48 | 9–13 | 16–20–10 | Very slight | 67.00 | |
| | | | | | | | 16–20– 0 | do | 56.66 | |
| | | | | | | | 20– 0– 0 | Slight | 45.04 | |
| | | | | | | | 0–10– 0 | do | 46.40 | |
| | | | | | | | | do | 37.00 | 50.42 |
| 3– | Canoni | 1,250 | do | 2.5 | 48 | 7–10 | 16–20–10 | Moderate | 44.45 | |
| | | | | | | | 16–20– 0 | Severe | 31.05 | |
| | | | | | | | 20– 0– 0 | Very servere | 14.50 | |
| | | | | | | | 0–10– 0 | do | 15.00 | |
| | | | | | | | | Almost total loss | 5.00 | 22.00 |
| 4– | Dinorado | 1,250 | do | 2 | 48 | 8–11 | 16–20–10 | Slight | 50.55 | |
| | | | | | | | 16–20– 0 | Moderate | 45.05 | |
| | | | | | | | 20– 0– 0 | Severe | 30.30 | |
| | | | | | | | 0–10 –0 | do | 30.00 | |
| | | | | | | | | do | 20.60 | 35.30 |
| 5– | Elon-elon | 1,250 | do | 2.5 | 48 | 8–12 | 16–20–10 | Slight | 71.00 | |
| | | | | | | | 16–20– 0 | do | 65.40 | |
| | | | | | | | 20– 0– 0 | Moderate | 49.05 | |
| | | | | | | | 0–10– 0 | do | 49.35 | |
| | | | | | | | | Severe | 30.80 | 53.12 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6– | Fortuna | 1,250 | do | 2.8 | 48 | 9–13 | 16–20–10 | Very slight | 63.40 | |
| | | | | | | | 16–20– 0 | Slight | 55.60 | |
| | | | | | | | 20– 0– 0 | do | 39.00 | |
| | | | | | | | 0–10– 0 | do | 38.85 | |
| | | | | | | | | Moderate | 33.15 | 46.00 |
| 7– | Guinangang | 1,250 | do | 2.5 | 48 | 8–11 | 16–20–10 | Slight | 51.50 | |
| | | | | | | | 16–20– 0 | do | 45.00 | |
| | | | | | | | 20– 0– 0 | Severe | 31.00 | |
| | | | | | | | 0–10– 0 | do | 31.60 | |
| | | | | | | | | do | 21.00 | 36.10 |
| 8– | Ketan Koetoek | 1,250 | do | 2.5 | 48 | 9–14 | 16–20–10 | Very slight | 70.90 | |
| | | | | | | | 16–20– 0 | do | 63.05 | |
| | | | | | | | 20– 0– 0 | do | 48.60 | |
| | | | | | | | 0–10– 0 | do | 49.05 | |
| | | | | | | | | Slight | 40.00 | 54.32 |
| 9– | Khao Bai Sri | 1,250 | do | 2.1 | 48 | 8–11 | 16–20–10 | do | 58.90 | |
| | | | | | | | 16–20– 0 | Moderate | 52.60 | |
| | | | | | | | 20– 0– 0 | Severe | 36.00 | |
| | | | | | | | 0–10– 0 | do | 36.55 | |
| | | | | | | | | do | 27.45 | 42.30 |
| 10– | Kinawayan | 1,250 | do | 2.5 | 48 | 8–10 | 16–20–10 | Slight | 46.50 | |
| | | | | | | | 16–20– 0 | Moderate | 39.00 | |
| | | | | | | | 20– 0– 0 | Severe | 27.55 | |
| | | | | | | | 0–10– 0 | do | 27.45 | |
| | | | | | | | | Very severe | 20.00 | 32.10 |
| 11– | Macan 1 | 1,250 | do | 2.3 | 48 | 8–11 | 16–20–10 | Slight | 56.95 | |
| | | | | | | | 16–20– 0 | do | 50.55 | |
| | | | | | | | 20– 0– 0 | Moderate | 33.00 | |
| | | | | | | | 0–10– 0 | do | 33.60 | |
| | | | | | | | | Severe | 23.00 | 39.42 |
| 12– | Macan Baret | 1,250 | do | 2.5 | 48 | 7–10 | 16–20–10 | Slight | 42.00 | |
| | | | | | | | 16–20– 0 | do | 32.30 | |
| | | | | | | | 20– 0– 0 | Severe | 26.75 | |
| | | | | | | | 0–10– 0 | do | 25.25 | |
| | | | | | | | | Very severe | 15.00 | 28.26 |
| 13– | Macan Bino | 1,250 | do | 2.2 | 48 | 7–10 | 16–20–10 | Slight | 40.00 | |
| | | | | | | | 16–20– 0 | Severe | 32.20 | |
| | | | | | | | 20– 0– 0 | do | 26.00 | |
| | | | | | | | 0–10– 0 | do | 25.30 | |
| | | | | | | | | Very severe | 17.00 | 28.10 |

TABLE 2.—*Transmission of 'Stunt' or 'Dwarf' disease of rice by the leafhopper "Nephotettix bipunctatus cincticeps" Uhler under open field conditions and the resistance displayed by some varieties as influenced by fertilizer treatment*—Continued.

| Index number | Variety | Number of plants per plot | Leafhopper used [1] | Approximate number of leafhoppers per plant [2] | Number of feeding hours (minimum) | Approximate incubation period (days) | Fertilizer treatment (N-P-K) | Degree of infection | Average yield in cavans per hectare | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Individual | General |
| 14– | Macan cumpol | 1,250 | do | 2 | 48 | 8–10 | 16–20–10 | Moderate | 45.55 | |
| | | | | | | | 16–20– 0 | do | 34.00 | |
| | | | | | | | 20– 0– 0 | Severe | 23.90 | |
| | | | | | | | 0–10– 0 | do | 25.05 | |
| | | | | | | | | do | 17.00 | 28.90 |
| 15– | Macan San Miguel | 1,250 | do | 2.6 | 48 | 8–10 | 16–20–10 | Moderate | 46.00 | |
| | | | | | | | 16–20– 0 | do | 39.50 | |
| | | | | | | | 20– 0– 0 | Severe | 27.50 | |
| | | | | | | | 0–10– 0 | do | 28.60 | |
| | | | | | | | | do | 18.00 | 31.92 |
| 16– | Macan Santa Rosa | 1,250 | do | 2.5 | 48 | 8–11 | 16–20–10 | Moderate | 47.40 | |
| | | | | | | | 16–20– 0 | do | 38.00 | |
| | | | | | | | 20– 0– 0 | Severe | 27.00 | |
| | | | | | | | 0–10– 0 | do | 29.90 | |
| | | | | | | | | do | 19.10 | 32.28 |
| 17– | Macan Señora | 1,250 | do | 2 | 48 | 8–12 | 16–20–10 | Slight | 51.05 | |
| | | | | | | | 16–20– 0 | Moderate | 42.50 | |
| | | | | | | | 20– 0– 0 | Severe | 30.40 | |
| | | | | | | | 0–10– 0 | do | 31.50 | |
| | | | | | | | | do | 23.05 | 35.70 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 18– | Macan Tago | 1,250 | do | 2.7 | 48 | 8–10 | 16–20–10 | Moderate | 44.00 | |
| | | | | | | | 16–20– 0 | do | 33.30 | |
| | | | | | | | 20– 0– 0 | Severe | 21.50 | |
| | | | | | | | 0–10– 0 | do | 22.80 | |
| | | | | | | | | Very severe | 14.20 | 27.16 |
| 19– | Magsanaya | 1,250 | do | 2.5 | 48 | 9–13 | 16–20–10 | Very slight | 53.70 | |
| | | | | | | | 16–20– 0 | Slight | 46.00 | |
| | | | | | | | 20– 0– 0 | do | 33.80 | |
| | | | | | | | 0–10– 0 | do | 35.25 | |
| | | | | | | | | Moderate | 27.95 | 39.34 |
| 20– | Malagkit Sungsong | 1,250 | do | 2 | 48 | 8–12 | 16–20–10 | Slight | 54.70 | |
| | | | | | | | 16–20– 0 | do | 47.80 | |
| | | | | | | | 20– 0– 0 | Moderate | 33.00 | |
| | | | | | | | 0–10– 0 | do | 35.20 | |
| | | | | | | | | Severe | 27.90 | 39.72 |
| 21– | Mancasar | 1,250 | do | 2.1 | 48 | 8–11 | 16–20–10 | Slight | 47.50 | |
| | | | | | | | 16–20– 0 | Moderate | 40.90 | |
| | | | | | | | 20– 0– 0 | Severe | 29.40 | |
| | | | | | | | 0–10– 0 | do | 31.00 | |
| | | | | | | | | Very severe | 20.10 | 33.78 |
| 22– | Milagrosa | 1,250 | do | 2.5 | 48 | 9–14 | 16–20–10 | Very slight | 63.85 | |
| | | | | | | | 16–20– 0 | do | 57.35 | |
| | | | | | | | 20– 0– 0 | Slight | 38.00 | |
| | | | | | | | 0–10– 0 | do | 40.00 | |
| | | | | | | | | do | 34.00 | 47.64 |
| 23– | Mimis | 1,250 | do | 2.3 | 48 | 8–10 | 16–20–10 | do | 48.10 | |
| | | | | | | | 16–20– 0 | do | 41.50 | |
| | | | | | | | 20– 0– 0 | Moderate | 29.90 | |
| | | | | | | | 0–10– 0 | do | 31.10 | |
| | | | | | | | | Severe | 21.00 | 34.32 |
| 24– | Pinili | 1,250 | do | 2 | 48 | 8–12 | 16–20–10 | Slight | 49.95 | |
| | | | | | | | 16–20– 0 | do | 42.75 | |
| | | | | | | | 20– 0– 0 | Moderate | 29.60 | |
| | | | | | | | 0–10– 0 | do | 31.40 | |
| | | | | | | | | do | 23.00 | 35.34 |
| 25– | Ramelon 2 | 1,250 | do | 2 | 48 | 8–12 | 16–20–10 | Slight | 59.80 | |
| | | | | | | | 16–20– 0 | do | 51.60 | |
| | | | | | | | 20– 0– 0 | do | 41.90 | |
| | | | | | | | 0–10– 0 | do | 43.00 | |
| | | | | | | | | Moderate | 30.00 | 45.26 |

TABLE 2.—*Transmision of 'Stunt' or 'Dwarf' disease of rice by the leafhopper "Nephotettix bipunctatus cincticeps" Uhler under open field conditions and the resistance displayed by some varieties as influenced by fertilizer treatment*—Continued.

| Index number | Variety | Number of plants per plot | Leafhoppers used [1] | Approximate number of leafhoppers per plant [2] | Number of feeding hours (minimum) | Approximate incubation period (days) | Fertilizer treatment (N-P K) [3] | Degree of infection | Average yield in average per hectare | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Individual | General |
| 26– | Raminad Str. 3 | 1,250 | do | 2.5 | 48 | 9–13 | 16–20–10 | Very slight | 79.00 | |
| | | | | | | | 16–20– 0 | do | 68.00 | |
| | | | | | | | 20– 0– 0 | Slight | 47.50 | |
| | | | | | | | 0–10– 0 | do | 48.50 | |
| | | | | | | | | Moderate | 35.00 | 55.60 |
| 27– | Seraup Besar 15 | 1,250 | do | 2.5 | 48 | 9–14 | 16–20–10 | Very slight | 84.30 | |
| | | | | | | | 16–20– 0 | do | 73.00 | |
| | | | | | | | 20– 0– 0 | Slight | 48.95 | |
| | | | | | | | 0–10– 0 | do | 50.35 | |
| | | | | | | | | Moderate | 40.00 | 59.32 |
| 28– | Seraup Kechil 36 | 1,250 | do | 2.2 | 48 | 9–13 | 16–20–10 | Very slight | 80.00 | |
| | | | | | | | 16–20– 0 | do | 68.00 | |
| | | | | | | | 20– 0– 0 | Slight | 45.50 | |
| | | | | | | | 0–10– 0 | do | 46.70 | |
| | | | | | | | | Moderate | 32.00 | 54.44 |
| 29– | Seraup Kechil 148 | 1,250 | do | 2 | 48 | 8–12 | 16–20–10 | Very slight | 72.00 | |
| | | | | | | | 16–20– 0 | Slight | 63.65 | |
| | | | | | | | 20– 0– 0 | Moderate | 46.55 | |
| | | | | | | | 0–10– 0 | do | 48.00 | |
| | | | | | | | | Severe | 30.00 | 52.04 |
| 30– | Sipot | 1,250 | do | 2 | 48 | 8–10 | 16–20–10 | Slight | 44.25 | |
| | | | | | | | 16–20– 0 | Moderate | 36.00 | |
| | | | | | | | 20– 0– 0 | Severe | 25.55 | |
| | | | | | | | 0–10– 0 | do | 26.00 | |
| | | | | | | | | Very severe | 15.00 | 29.36 |
| 31– | Taichu 65 | 1,250 | do | 2.5 | 48 | 7–10 | 16–20–10 | Slight | 50.00 | |
| | | | | | | | 16–20– 0 | Moderate | 38.70 | |
| | | | | | | | 20– 0– 0 | Very severe | 19.40 | |
| | | | | | | | 0–10– 0 | do | 21.00 | |
| | | | | | | | | Almost total loss | 7.00 | 27.22 |
| 32– | Wagwag A | 1,250 | do | 2.4 | 48 | 8–12 | 16–20–10 | Slight | 73.00 | |
| | | | | | | | 16–20– 0 | do | 61.50 | |
| | | | | | | | 20– 0– 0 | Moderate | 38.30 | |
| | | | | | | | 0–10– 0 | do | 40.00 | |
| | | | | | | | | Severe | 29.00 | 48.36 |

[1] Positively phototropic insects particularly *Nephotettix bipunctatus cincticeps* Uhler which have been attracted by lighted lanterns for two successive dark nights starting at 6 to 10 o'clock in the evening.

[2] Based on actual counts made of adult leafhopper per plant before starting light-trapping.

[3] Complete fertilizer (16–20 10) and Warnerphos (16 20 0) were applied at the rate of 150 Kg. per hectare each; Sulphate of ammonia (20–0–0) and bat guano (0–10–0), at 120 Kg. and 300 Kg. per hectare each, respectively.

Warnerphos (16–20–0) at the same rate; the third, with Ammonium sulphate (20–0–0) at 120 Kg. per Ha.; the fourth, with bats Guano (0–10–0) at 300 Kg. per Ha.; while the fifth was left without any treatment at all as check. Planting and fertilizing were done alternately.

After three weeks, 6 lighted lanterns were set out in strategic points of the field for two successive nights from 6 o'clock p.m. to 10 o'clock p.m. This was for the purpose of attracting and concentrating in the experimental field all the insect vectors around the vicinity. For 3 consecutive weeks thereafter, light traps were set to catch the same insect population for the purpose of relieving the plants of any possible physical injury resulting from the excessive feeding. The results of the tests are given in Table 2.

*Fifth transmission tests.*—Partly because of previous erroneous reports(12) there is a prevailing impression among farmers including some technical men in Government service that stemborers have something to do with the incidence of accep na pula disease of rice. These tests are aimed to demonstrate that accep na pula is caused by an infective virus transmitted by the rice leafhoppers *N. bipunctatus cincticeps* Uhler, and not by any of the stemborers.

The same procedure and technique were adopted here as in the preceding transmission tests and Canoni and Milfor 6 were used as the host plants, *N. bipunctatus cincticeps* Uhler as the insect vector, and *Chilo simplex* Butler and *Schoenobius incertellus* Walker as the insect pests. The results are given in Table 3.

*Transmission by mechanical means.*—To determine whether or not the accep na pula virus can be transmitted through means other than the insect vector *N. bipunctatus cincticeps* Uhler, several laboratory tests were conducted using sap injection, sap application through bruises, and needle-pricking. These methods which were adopted by previous investigators on abaca mosaic,(7) sugar cane mosaic,(11) and tobacco mosaic(8) all gave negative results.

*Transmission through seeds.*—By way of determining the possibility of transmission through seeds, palay seeds from infected plants of Apostol, Wagwag, Elon-elon, Canoni, and Milketan were planted and allowed to mature inside insect-proof wire cages. All plants turned out to be healthy and free from

TABLE 3.—*Transmission of 'Stunt' or 'Dwarf" disease of rice by the leafhopper "Nephotettix bipunctatus cinticeps" Uhler and artificially reproduced typical symptoms—descriptive of the real 'Accep na Pula' disease, in contrast with 'Tamasok' or 'Uban' caused by stemborers Chilo simplex Butler and Schoenobius incertellus Walker.*

| Series number | Date of transmission | Variety | Number of plants | | Kind of insects | Source of insects | Number of insect per plant | Number of plants infected /or infested | Degree of infection/ or infestation | | Symptoms |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Treated | Check | | | | | Canoni | Milfor 6 | |
| 1: A– | 1-5-53 | Canoni and Milfor 6 | 2 | 0 | *N. bipunctatus* | Guiguinto Station | 1 | 1 | Severe | Healthy | Canoni: All infected, with chlorotic lesions, yellowing, reddening, and stunting. Milfor 6: All healthy, green, and robust. |
| B– | | do | 2 | 0 | do | do | 1 | 1 | do | do | |
| C– | | do | 2 | 0 | do | do | 1 | 1 | do | do | |
| D– | | do | 2 | 0 | do | do | 1 | 1 | do | do | |
| E– | | do | 2 | 0 | do | do | 1 | 1 | do | do | |
| | | do | 0 | 2 | None | None | None | None | Healthy | Healthy | Normal, green, and robust. |
| 2: A– | do | Canoni and Milfor 6 | 2 | 0 | *C. simplex* | Central Station | 1 | 2 | Severe | Moderate | Straw-colored leaf-sheath and dead terminal bud or "Tamasok", resulting from infestation. But no reddening, no stunting, no chlorotic lesions. |
| B– | | do | 2 | 0 | do | do | 1 | 2 | Moderate | do | |
| C– | | do | 2 | 0 | do | do | 1 | 2 | do | do | |
| D– | | do | 2 | 0 | do | do | 1 | 2 | Severe | do | |
| E– | | do | 2 | 0 | do | do | 1 | 2 | Moderate | do | |
| F– | | do | 0 | 2 | None | None | None | None | Healthy | Healthy | Normal, green, anp robust. |
| 3: A– | do | Canoni and Milfor 6 | 2 | 0 | *S. incertellus* | Guiguinto Station | 1 | 2 | Severe | Moderate | The same as in *C. simplex*. At flowering stage, infestation by both species cause severance of young panicles at basal attachment, thereby producing white head or 'Uban'. |
| B– | | do | 2 | 0 | do | do | 1 | 2 | do | do | |
| C– | | do | 2 | 0 | do | do | 1 | 2 | do | do | |
| D– | | do | 2 | 0 | do | do | 1 | 2 | Moderate | do | |
| E– | | do | 2 | 0 | do | do | 1 | 2 | do | do | |
| | | do | 0 | 2 | None | None | None | None | Healthy | Healthy | Normal, green and robust. |

any sign of accep na pula disease. This indicates that, like tobacco mosaic and others,(8) stunt disease virus is not seed-borne.

## PHYSIOLOGY OF TRANSMISSION

The transmission of the disease to healthy rice plants by the viruliferous leafhoppers has been observed to take place within 7 to 14 days depending, among other factors, on: (*a*) the degree of resistance or susceptibility of the host; (*b*) the age of the host plant at the time of infection; and (*c*) the intensity of the infective virus within the cells and tissues of the host plant as governed largely by the number of feeding days allowed the insect vector.

The potency of the stunt virus within the body system of the insect vector does not seem to change either. This was indicated by practically the same virulence with which viruliferous adult leafhoppers transmitted the disease successively to healthy rice seedlings one after another. This was also observed in the case of the viruliferous nymphs in estivation during summer days in areas where no second crops were planted. This, together with the absence of the second crop explains the annual recurrence of the disease despite the fact that accep na pula virus is not seed-borne.

## DISCUSSION OF RESULTS

*First, second, and third transmission test.—N. bipunctatus cincticeps* Uhler (Table 1, Series 1) transmitted *accep na pula* disease to healthy young seedlings of Apostol with 72 per cent success in 2 hours feeding time. This rose to 88 per cent when feeding hours were increased from 2 to 24. All infected plants either died or became 'dwarf' or severely stunted and displayed characteristic chlorotic spots, yellowing and reddening of foliage within 2 months, then finally drying towards the tips of leaves. Seedlings, however, on which *N. apicalis* Motsch was used remained normal, green and robust like the check. These findings prove that the two leafhoppers, although closely related, are distinct and different from each other not only morphologically but also physiologically, at least insofar as the transmission of stunt disease is concerned.

Where fully developed estivating nymphs of *Nephotettix* spp. were used for the second transmission experiment, positive infections ranging from 40 to 60 per cent were effected on the healthy seedlings of Wagwag in 2 to 24 hours feeding

time. Such a rate indicates that the virus is retained within the body system of the insect vector from nymphal to adult stage (Table 1, Series 2). The low percentage of infection may be explained by the fact that after molting, the two closely related species have been found almost equally represented among the adult leafhoppers. Only about half of the seedlings were infected because of the nonviruliferousness of *N. apicalis* which was revealed as early as the termination of the first series. All the check plants remained normal, green, and robust. This ability of the nymphs to tide-over during summer in places where no second crop of rice is grown and their power to maintain the potency of the infective virus in their body system for so long, fully account for the annual recurrence of accep na pula disease in those areas.

The third transmission tests (Table 1, Series 3) also show conclusively, like the first and second series, that: (*a*) the so-called kadang-kadang of rice in the Bicol Region is the same as accep na pula disease in Bulacan and other provinces of Luzon; (*b*) both diseases are caused by an infective virus transmitted by the leafhopper *N. bipunctatus cincticeps* Uhler; (*c*) the feeding time of 2 hours is sufficient to allow transmission of the virus, but 24 hours is necessary to cause 100 per cent infection and to exhibit chlorotic spots within 7 to 9 days which represents the incubation period; and (*d*) this initial infection in the form of chlorotic spots finally develops into the typical accep na pula disease with all the characteristic symptoms as found in the fields, such as yellowing and reddening of the foliage dotted with chlorotic spots and general stunting of the entire plant, followed by drying towards the tips of leaves.

*Fourth transmission tests.*—The results of the transmission experiments for variety resistance were most revealing (Table 2). While many of the standard varieties are highly susceptible to accep na pula disease, a few like Ketan Koetoek, Milagrosa, Buenavista, Magsanaya, Seraup Besar 15, Fortuna, and others prove very highly or 'commercially resistant,' at least. In fact, Ketan Koetoek top the list with only 2 per cent infection, followed by Milagrosa with 4 per cent and Buenavista with 5 per cent. Coincidentally, these three varieties were found to be early maturing and fairly good yielders of very good to excellent quality product, producing as much as 60 to 80 cavans per hectare when fertilized. They are,

however, deficient in that the demand for Ketan Koetoek, which is a glutinous variety, is naturally limited; the yield of Milagrosa is not so good because it has very fine grains, is seasonal, lodging, quite susceptible to stemborers, and is good only for lowland planting; the yield of Buenavista and its milling quality are not fully satisfactory; Magsanaya proves quite susceptible to rice blast and stemborers; Fortuna also turns out to be easily affected by stemborers and is only good for upland planting; and Seraup Besar 15 is seasonal, matures late, produces ordinary quality product and is good only for lowland planting.

Another important feature of the experiments is the beneficial effect obtained from the timely application of the right kind of fertilizers. The results seem to indicate that the more susceptible the variety is, the greater the beneficial effect would be in terms of increased yield per hectare. This does not mean, however, that fertilizers are a 'cure' for the disease, although it may be said that they act as a preventive when applied early before the infection takes place. Fertilizer gives a stimulating effect on the health and vigor of the plants treated and places them in a better condition to ward off the disease. Late applications of fertilizers on the land prove to be futile. In fact, when mildly infected plants are treated with nitrogenous fertilizers, the disease becomes more conspicuous and alarming although the number of infected plants is not necessarily increased. In view of this phenomenal reaction resulting from late treatments with nitrogenous fertilizers in diseased rice fields, many farmers ascribed the ravages wrought by accep na pula disease on fertilizers.

Of the four kinds of fertilizer used in the experiments, Complete Fertilizer with 16–20–10 formula gave the best results, followed by Warnerphos 16–20–0. Sulphate of ammonia 20–0–0 and bats Guano 0–10–0 when applied singly, barely gave any beneficial effect. This is due to the fact that the San Ildefonso soils are depleted, eroded and deficient in nitrogen, potassium, organic matter, and the trace elements, but especially in phosphorus. Phosphoric acid is needed in the root and grain development of the rice plant. The presence of phosphorus in sufficient quantities is also essential to the promotion of chemical as well as biological normal transformations in the soil and accounts for healthier, better and more productive plants. This explains why in areas where phosphorus

deficiency is well marked, no amount of nitrogenous fertilizer treatment can turn the plants productive until such deficiency is first corrected. This also explains why many rice farmers who use nothing else but ammonium sulphate in fertilizing their rice fields get stung and lose their crop.

*Fifth transmission test.*—The results (Table 3) of the tests for differentiation between accep na pula and *tamasok* revealed the following:

(*a*) Contrary to previous reports(1, 12), the stemborers take no part in the causation of accep na pula, the disease being caused by an infective virus transmitted by the leafhopper *N. bipunctatus cincticeps* Uhler.

(*b*) The stemborers produce tamasok or uban with the characteristic symptoms typical of insect attack and destruction, such as the appearance of straw-colored leafsheath, the presence of minute holes and borings on the rice culm and stem, and the appearance of straw-colored dying terminal leaf. On account of the entrance of the bigger caterpillars into the base of the leaf of the growing plant, the leaf is severed from the stem, producing what is popularly known in the Visayas as *tamasok*. When the young forming panicle is affected instead of the leaf, it is severed from its basal attachment in the same manner as the terminal leaf, producing sterile white panicle called *uban* in the Tagalog provinces.

(*c*) While canoni is very susceptible to accep na pula disease, Milfor 6 is so highly resistant that it is almost immune to it.

(*d*) Unlike most plant diseases, the stemborers under captivity in insect-proof wire cages show practically no preference for any host plants.

(e) Accep na pula disease is very much more destructive than all the stemborers combined. (Plate 5)

## FACTORS FAVORING INCIDENCE OF THE DISEASE

In the formulation of a concrete, cheap and effective control measure for any disease or pest, a general knowledge of conditions and factors favoring the incidence of the malady is essential. The following are among such factors which should be considered first:

1. The prevalence of the insect vector as affected by climate. As observations of the farmers in infected areas indicated, the rice leafhoppers which transmit and spread accep na pula disease begin to disappear in November and to show up in June

or July depending on the resumption of the rainy days, only to disappear again the following November. The leafhoppers do not actually disappear, as was noted before in this report; they are merely reduced in number. Only the estivating nymphs survive and tide-over during summer months. The incidence of the insect vector is thus controlled by climate, atmospheric humidity and temperature. Longer rainy days or more uniform distribution of annual rainfalls favor the survival of the insect vector. On the other hand, a long-drawn spell of dry weather may be almost inhibitory to their existence.

These facts are borne out by the number of adult leafhoppers caught in light-trapping every night all the year round. This explains why the Japanese rice Taichu 65 which is found to be very susceptible to stunt disease could be successfully grown as *palagad* but not as a regular or rainy season crop under Philippine conditions, especially if it is transplanted as late as August. The Japanese Imperial Army had this sad experience when it tried to grow Taichu 65 in the barrio of Bahay Pare, Candaba Municipality, Pampanga Province for two consecutive years during the Second World War.

2. Abundance of suitable host plants. Rice leafhoppers unquestionably subsist during summer months on intermediary hosts of drought-resistant grasses in areas where no second crop of rice is planted for lack of irrigation water. It may be presumed, however, that they prefer their natural host—the rice plant. As the so-called standard varieties have been found by actual comparative variety tests to be susceptible to accep na pula disease, the continued planting of such varieties aids in the perpetuation and further spread of the disease. This poses a great stumbling block in the proper development of the local rice industry.

3. Soil depletion. According to Weir(18) rice grows best in medium acid soils with a reaction of pH 5.5 to 6.1. A general survey made on the preponderance of the malady in the important rice provinces of Luzon Island revealed that accep na pula is more prevalent and more devastating in areas where the soil is the acidic with pH ranging from 4.5 to 5.0, poor and depleted. Previous investigators(2, 13) were led to ascribe the cause of the disease to soil depletion, which is generally associated with high acidity, for this reason. But soil deficiency is just a predisposing cause favoring incidence of the disease.

## PROPOSED CONTROL MEASURES

In meeting any phytopathological or entomological problem, the formulation and programming of a concrete, effective and cheap control is important after the true nature and cause of the trouble have been definitely determined. It is mainly for this reason that the publication of this paper has been much delayed. Although strong indications have been established in the preliminary investigations that some fancy, early maturing varieties are highly resistant to accep na pula disease, it has been noted that other deficiencies of the plants could be eliminated only through breeding and well-directed selection. Thus, efforts have been directed to the production of better varieties and seeds by the use of Ketan Koetoek, Milagrosa, Buenavista, and Fortuna varieties as parent plants in order to perpetuate rice crops of superior qualities.

Among the natural and artificial crosses produced in nearly one and a half decades as reported recently by the author(16), *Buenketan* (Buenavista x Ketan Koetoek), *Milketan* (Milagrosa x Ketan Koetoek), *Milfor* (Milketan x Fortuna), and *Milbuen* (Milfor x Buenketan) have been found to be outstanding. Out of the many strains produced under these creations, final selections have narrowed down the number to 2 for Buenketan, 4 for Milketan, 5 for Milfor, and 5 for Milbuen, all of which strains are superior in many respects to the present standard variesties.

Buenketan 99, Buenketan 101, Milfor 6, Milfor 39, Milbuen 3, Milbuen 5, Milbuen 6, Milketan 20, and Milketan 21, etc. were selected because they are exceedingly resistant to stunt or accep na pula disease. They yield crops of excellent quality with superior milling recovery and head rice as well as high nutritional values. They are resistant to blast, brown spot, stemborers, drought, flood, and strong wind as well as to lodging and shattering. They mature early and are not seasonal, hence may be planted at least twice a year. They are adopted to either lowland, palagad or upland planting. There are strains which ratoon well to produce 3 crops a year with one seeding alone. Because of these desirable qualities, these hybrids can compete with the best stock in the world. The commercial planting of these varieties throughout the principal rice-producing regions of the Philippines would be the most practical, effective and the cheapest control for accep na pula disease.

Aside from planting the highly resistant varieties and strains, proper soil treatment and spraying or timely light-trapping

would greatly help in reducing the ravages caused by accep na pula disease to the minimum.

In regions where the land has been depleted by reason of continuous planting year-in and year-out and the farmers make no attempt to remedy or improve the soil conditions, proper soil treatment with commercial fertilizers, composts, and green manures is the proper measure to take to minimize the ravages caused by the disease. Such state of the soil does not however entirely preclude infection especially if the host plant happens to be of the highly susceptible strain. The use of insecticide sprays like endrin (0.04 per cent) has proven to be effective in eliminating the leafhopper vector, but it is inadequate after the infection has set in, unless the crop variety is of the resistant type. Timely light-trapping during the preparation of the field greatly depreciates the insect population. All these measures would be most beneficial and efficacious if they are coordinated with timely planting and are adopted by rice farmers all over the country.

## SUMMARY

1. The geographical distribution, economic importance, cause and symptoms of *accep na pula,* the most serious disease of rice in the Philippines are given.

2. *Accep na pula* (Tagalog), *kadang-kadang* (Bicol), *tungro* (Iloko and Pampango), *po-ol* or *po-or* (Pangasinan), *los-ong* (Negros Occidental), *tagostos* (Iloilo) and *sebukaw* (Bohol) are some of the local names under which the disease is known.

3. Spread all over Luzon Island, it has recently been reported in Negros Occidental, Bohol, Leyte, Samar, Cotabato as well as in certain municipalities in Iloilo Province. Plants affected by the disease are generally stunted, with characteristic yellowish-white lesions on the leafblades. When severely affected they become 'dwarf,' 'rosetting' and produce, if they can, abortive panicles with abnormal discolored seeds.

4. The vector is that viruliferious rice leafhopper (*Nephotettix bipunctatus cincticeps* Uhler) which transmits the virus causing accep na pula disease within 2 hours feeding time. The predisposing cause of the disease is soil deficiency.

5. Contrary to common belief of farmers, the insect vector does not entirely disappear during the summer months but estivates as a fully-grown nymph, subsisting on drought-resistant grasses.

6. Nymphs carry in their body system the infective virus with its potency unchanged, accounting for the periodic (annual)

recurrence of the disease despite the fact that the virus is not seed-borne.

7. The tagalog name *accep na pula* means red disease, which is the most descriptive as it appears in the field. It is for this reason that this was chosen to differentiate this particular systemic disease from other virus diseases of rice like 'leaf-gall', 'mosaic' and streak', each of which has one definite and distinct characteristic of its own not common to the others. On the other hand, all of the systemic diseases as a group invariably show 'dwarfing' or stunting, as a result of the arrested growth of the host plant subsequent to infection. Therefore, to use 'dwarf', 'stunt' or any other name for that matter, would be a misnomer and confusing. Secondarily, this would in due course erase from the minds of the Filipino rice farmers in particular and the public in general, the imprint left by the erroneous publications associating the stemborers with *accep na pula* disease.

8. *Accep na pula* causes destruction many times greater than the stemborers combined. It is conservatively estimated that an annual loss of 31,000,000 cavans of palay or 30 per cent of the total production, is lost through the disease. This obviously explains why Philippine average production per hectare has oscillated between 27 and 28 cavans during the last 20 years despite attempts at improvements through the introduction of foreign varieties, better cultural methods, more irrigation, and the use of fertilizers.

9. Present standard varieties have been found susceptible to *accep na pula* to a greater or lesser degree. As even those showing a high degree of resistance to the disease show certain deficiency, the production through hybridization and selection of better varieties and seeds endowed with a higher degree of resistance and possessing desirable agronomic qualities should be preferred.

10. Buenketan 99, Buenketan 101, Milfor 6, Milfor 39, Milbuen 3, Milbuen 5, and Milbuen 6 created and stabilized by nearly one and a half decades of continuous, painstaking researches and experimentations may yet provide the positive solution to the problem of the *accep na pula* disease and to the proper and permanent development of the Philippine rice industry.

## RECOMMENDATIONS

1. To relieve rice areas of the accep na pula or stunt disease, such better varieties as Milfor, Buenketan, Milbuen, and Milketan should be planted instead of the susceptible varieties now being used.

2. In places where the soil is already over-used and depleted due to continuous cropping and the lack of attempts on the part of farmers to ameliorate soil conditions, the application of compost, manures, and FASCOM (10–10–24M) complete fertilizer based on soil analysis should be resorted to.

3. To obtain maximum yield, the seedlings must be transplanted at the age of 2 to 3 weeks, setting out one plant per hill spaced 10 x 10 centimeters. Neither weeding nor cultivation is necessary. All the farmer has to do is prepare the ground well and control the water in the paddies, which, in turn will put the weeds under control. About 2 to 3 inches of moving water is sufficient.

4. The multiplication and expansion of these new versatile varieties and strains especially the ratooning types to replace present inferior standards should be accelerated and pushed through by the government. This can be accomplished as follows:

*a.* Adopt a new rice policy that is responsive to present needs by replacing the present policy which has proved to be obsolete and unrealistic.

*b.* Give farmers such incentives as will make rice farming profitable business venture. The maintenance of a reasonable price support is also necessary and important to induce farmers to produce more not only to supply local needs but also for export abroad where the product, provided it is of high quality, will easily find a ready market.

*c.* To improve present rice seedfarms the sum of at least ₱3,000,000 should be appropriated. From these seedfarms where pure stocks of the chosen national varieties and strains should be continuously propagated, farmers may draw reasonable quantities to replace their old stocks every 3 to 4 years.

*d.* Big rice farmers should be encouraged to go into certified seed production.

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# ILLUSTRATIONS

## Plate 1

Fig. 1. Milfor 6, semi-commercially planted at Guiguinto Station, Bulacan, shown maturing, with long panicles heavily ladden with grains.

2. Canoni severely stunt-infected, maturing with but very few abortive panicles formed, in contrast with excellent stand of Buenketan and Milfor at background free from infection. All plants were semi-commercially planted at Guiguinto Station, Bulacan.

## Plate 2

Fig. 1. Excellent stand of lush Buenketan at maturing stage at background, and Canoni completely devasted by stunt disease at foreground.

2. An excellent stand of lush maturing Milfor 6 free from stunt *left* and Canoni in complete waste due to severe stunt attack *right*. All in Libis, Camp Murphy, Quezon City.

## Plate 3

Fig. 1. A mature plant seriously affected by stunt disease, showing general stunting of entire plant with formation of but few deformed and abortive panicles.

2. Abortive panicles resulting from severe stunt infection, showing deformation and discoloration of grains, and slight twisting of leafsheath of flagleaf.

## Plate 4

Fig. 1. Healthy maturing ratoon crop of Milketan with 45 long panicles heavily ladden with full size grains (*left*); stunt-infected ratoon of Milketan showing 5 abortive panicles and total height of plant reduced by almost 50 per cent (*right*). Infection started on plant crop.

2. Ratoon of Japanese rice No. 29, showing severe 'rosetting' as a result of stunt infection on plant crop (*left*); same plant free from infection (*right*). Note short panicles ladden with full size grains.

## Plate 5

Fig. 1. Transmission of 'Accep na Pula' disease on Canoni and Milfor 6 through viruliferous *N. bipunctatus cincticeps* Uhler. Canoni (*left*) showing severe manifestation of disease 1½ months after infection. Note general stunting coupled with yellowing to reddening discoloration of practically all leaves in contrast with Milfor 6 (*right*) showing apparent freedom from symptoms of the malady.

2. Check, in the same arrangement as in Fig. 1, with both plants normal, healthy, and lush, especially Canoni on left.

3. Same as in Fig. 1, 2 months after infection. Note more advanced stunting and reddening of the leaves of Canoni on left in great contrast with healthy, vigorous-looking Milfor 6 on right.
4. Check, as in Fig. 2, all green, healthy and sound.
5. As in others, with Canoni (*left*) and Milfor 6 (*right*), but both infested by young caterpillars of *Chilo simplex*. Note straw-colored leafsheath and terminal leaves, a condition popularly known as *Tamasok* in Bisayan.

*1*

*2*

PLATE 1.

1

2

PLATE 2.

1

2

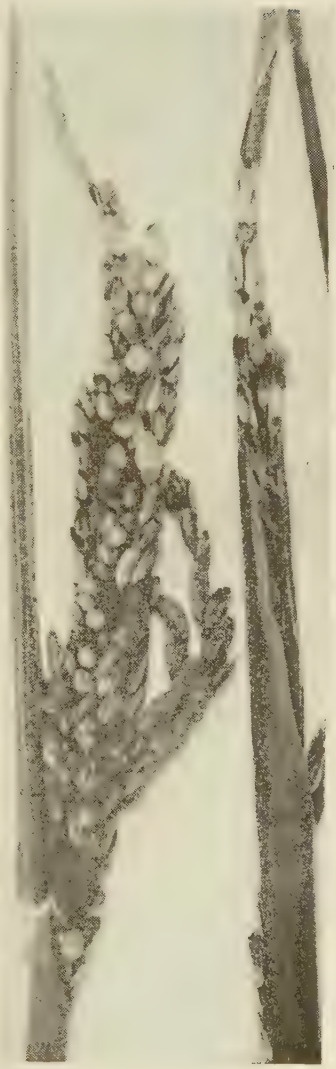

PLATE 3

1

2

PLATE 4.

1 2

3 4 5

PLATE 5.

## BOOKS

**Books received from time to time by the Philippine Journal of Science are reviewed and acknowledged in this section.**

**Instrumental Analysis. By Paul Delahay. New York, MacMillan Company, 1957. 384p. Price $7.90.**

This book deals with the application of the methods of physics and physical chemistry to chemical analysis. Focused on the fundamentals of instrumental analysis, rather than on the specifications of particular instruments, it covers three main groups of methods: (*a*) electrochemical methods for which Professor Delahay, the author of this book, received the 1955 award in Pure Chemistry of the American Chemical Society; (*b*) spectroscopic methods; and (*c*) miscellaneous methods, which include X-rays, mass spectrometry and radio-active methods.

The book includes specific problems covering the intension and application of theory and a detailed bibliography at the end of last chapter. It also provides instruction for 50 experiments in 23 groups, with suggestions on more than 20 additional experiments.

As a whole, the book is very instructive and should be very useful not only to students of analytical chemistry but also to professional chemists engaged in analytical work in the Philippines.—E.P.R.

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## PUBLICATIONS AVAILABLE

CONTENTS AND INDEX. THE PHILIPPINE JOURNAL OF SCIENCE, vol. 1 (1906) to vol. 10 (1915). Bureau of Science Publication No. 8 (1917). Paper, 442 pages. Price, $2.00 United States currency, postage extra.

SECOND TEN-YEAR INDEX. THE PHILIPPINE JOURNAL OF SCIENCE, vol. 11 (1916) to vol. 28 (1925). Compiled by Winifred I. Kelley. Bureau of Science Monograph 26. Paper, 382 pages. Price, $2.00 United States currency, postage extra.

CHECKLIST OF THE ANTS (HYMENOPTERA: FORMICIDÆ) OF ASIA. By J. W. Chapman and S. R. Capco. Institute of Science and Technology Monograph 1 (1951) new series. Paper, 327 pages. Price, $2.00 United States currency, postage extra.

NOTES ON PHILIPPINE MOSQUITOES, XVI. GENUS TRIPTEROIDES. By F. E. Baisas and Adela Ubaldo-Pagayon. Institute of Science and Technology Monograph 2 (1952) new series. Paper, 198 pages with 23 plates and 4 text figures. Price, $2.50 United States currency, postage extra.

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## PUBLICATIONS AVAILABLE—Continued

A REVISION OF THE INDO-MALAYAN FRESH-WATER FISH GENUS RASBORA. By Martin R. Brittan. Institute of Science and Technology Monograph 3 (1953) new series. Paper, 224 pages with 3 plates and 52 text figures. Price, $2.50 United States currency, postage extra.

SECURING AQUATIC PRODUCTS IN SIATON MUNICIPALITY, NEGROS ORIENTAL PROVINCE, PHILIPPINES. By Donn V. Hart. Institute of Science and Technology Monograph 4 (1956) new series. Paper, 84 pages with 22 text figures and 8 plates. Price, $1.25. United States currency, postage extra.

AN ECOLOGICAL STUDY OF THE KOUPREY, NOVIBUS SAUVELI (Urbain). By Charles H. Wharton. Institute of Science and Technology Monograph 5 (1957) new series. Paper, 111 pages with 11 plates and 16 text figures. Price, $1.25. United States currency, postage extra.

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